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# DISCOVERY

A Monthly Popular Journal of Knowledge

August 1935

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By Dr. L. Dudley Stamp



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# DISCOVERY

A Monthly Popular Journal of Knowledge

Vol. XVI. No. 188. AUGUST, 1935

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Publishers: BENN BROTHERS, LTD. All communications respecting editorial matters to be addressed to the Editor; all questions of advertisements and subscriptions to the Manager.

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## Notes of the Month.

OUTSTANDING among last month's events in the world of science was the opening of the new Museum of Practical Geology, at South Kensington, by H.R.H. the Duke of York. As we mentioned in our May issue, the opening of the new building coincides with the centenary of the Museum, for it was when the Geological Survey was established in 1835 that De la Beche was officially authorised to proceed with the collection of "specimens of the applications of geology to the useful purposes of life." He proceeded to such purpose that by 1839 the appointment of a Curator for the collections was found essential, while the original quarters at Craig's Court, Whitehall, soon became so cramped that in 1851 a move had to be made to the long-famous "Jermyn Street Museum." The walls of that museum are at this moment falling before the pickaxe of the demolisher, and Piccadilly will soon see no more of its most incongruous building.

\* \* \* \*

A visit to the new building at South Kensington soon shows how far we have advanced from the ideas and ideals of 1851. Mr. J. H. Markham, F.R.I.B.A., of H.M. Office of Works, has made a notable addition to London's public monuments. Functionally and aesthetically, the building serves its purpose admirably, and the exhibition-hall, with its spacious ground floor and two tiers of galleries, offers every encouragement to the general public to enter and interest themselves in the exhibits. Much has been written of the "forbiddingness" of the conventional museum atmosphere;

that is totally absent here, and the most convinced lowbrow can safely inspect the marvellous display of precious stones without fear of being made to feel uncomfortable. The systematic collections are excellently arranged and the small details have been dealt with in a pleasant way, as, for instance, by the use of British marbles to decorate the entrance-hall, which we illustrate on the next page.

\* \* \* \*

We regret to have to announce the untimely death of two editorial colleagues well known in the front rank of specialised journalism. Just after we had gone to press last month the news came to hand of the death of Captain Edward W. Gregory, editor of our senior associated journal, *The Cabinet Maker*, from 1927 to 1934. While on holiday last year he met with an accident from which he never fully recovered, and which obliged him to relinquish active editorial work. Gregory stood out as a journalist of the best type, one who had an intimate knowledge of the trade with which his journal was connected and who would never tolerate any malpractice or any attempt to bring unjustified pressure to bear, whether in favour of the publication or the suppression of news. He leaves a fine tradition for his successors to follow up.

\* \* \* \*

Dr. Robert Saudek, the accomplished editor of *Character and Personality*, died in harness at the early age of 54. Most famous, no doubt, for his brilliant studies in graphology—his monumental work, *Psychology of Handwriting*, appeared in 1925—he was a man of versatile talents: some idea of the surprising variety of his published work may be gleaned from the obituary notice in the June issue of *Character and Personality* (Allen & Unwin: 2s.). The world of cosmopolitan journalism, and the science of graphology in particular, have lost a brilliant exponent whose place will be very hard to fill.

\* \* \* \*

British wireless exhibits are prominent in the "Albertum" Palace of Science, at the Brussels Exhibition, a series of exhibits representing varied modern applications of wireless and high-frequency technique,

contributed by the Marconi Company, occupying one of the principal sections. The diathermy apparatus represents the new method of applying high-frequency technique, with radio valve apparatus, to healing and surgery. Equipment of this type is being increasingly adopted for regular practice as well as for experiment and research, but it is still unfamiliar to the general public who will have an opportunity of seeing it at this Exhibition. Among the historical apparatus are replicas of Marconi's first short-wave directional transmitter and receiver (1897) with copper reflectors to provide the "beam" effect, and early valves from 1904 onwards.

\* \* \* \*

This year's Glasgow meeting of the Society of Chemical Industry (the fifth in that city) was particularly successful, and the papers were decidedly out of the ordinary. Starting with a discourse by the President, Alderman Edwin Thompson, on national water supplies, the programme comprised an exceptionally interesting review of chemical engineering problems in the Navy, two papers at the Food Group session on food transport by rail and sea, and lastly, Dr. E. F. Armstrong's ably conceived and admirably delivered Medal Lecture on "The Past, the Present, and the Future."

\* \* \* \*

Dr. Armstrong began on what may be described as an alarmist note, and discoursed coolly on the next war. "It cannot be gainsaid that the war found us chemically unprepared," he stated. "If it is true that another war—may it be very remote—will make an even greater, in fact an unprecedented call on our chemical resources, it behoves us to be prepared to make in quantity all those substances which are likely to be required at



Museum of Practical Geology, London: the entrance-hall, decorated with British marbles.

[By courtesy of the Editor of *The Museums Journal*.

short notice." His glimpses of the future, however, were much more concerned with the peaceful activities of the chemist than with preparation for hostilities. Chemists have their opportunity to-day as never before.

\* \* \* \*

As forecast in Major Klein's important article in the July issue of this journal, the coloured talking film is now with us. *Becky Sharp*, a very much revised version of the adventures of the heroine of *Vanity Fair*, was presented at the New Gallery Cinema, Regent Street, on July 10th. The general reaction of the public seems to be a sigh of thankfulness that it was no worse; the early "talkies" were a stiff lesson for film-goers. This somewhat grudging appreciation actually does the film bare justice. True, it is not an artistic triumph, and neither the colours nor the focussing are absolutely right, but it is none the less a great technical achievement, and such departures from the natural as are observable in the colour reproduction are in no way offensive. Fringing, that infuriating defect caused in some earlier efforts by excessive parallax, was entirely absent, and some of the scenes at the Waterloo Ball remain with real and vivid pleasure in the memory. Mr. Mamoulian and the proprietors of Technicolour are, on the whole, to be congratulated on their first full-length three-colour film.

\* \* \* \*

Dr. Malcom Burr, well known to readers of *Discovery* as traveller, entomologist, and geologist, first went to Montenegro in 1898 to hunt butterflies. This was the beginning of his adventurous career, of some of the most dramatic parts of which he has given us a vivid account in *Slouch Hat*, published by Allen & Unwin on July 30th (15s.). This is a collection of adventures in the Balkans between 1898 and 1921. The author gives an entertaining account of his exploits before, during, and after the War. Apart from the exciting adventures the book is interesting and valuable for the fine picture it provides of the Serbian people, their lives, and habits.

\* \* \* \*

The June, 1935, number of *Ancient Egypt and the East* (Macmillan, 4s.) contains an interesting account, by Sir Flinders Petrie, of his recent work in Syria and Sinai. Especially courageous was the work done on the tells in the neighbourhood of Sheikh Zowaiyid, between Rafa and El Arish; any of the troops engaged in the advance on Gaza in 1917 will be familiar with the uncompromising nature of the sandhills on that inhospitable shore; sufficient comment is provided by Sir Flinders's announcement that it was considered advisable to suspend excavation when the shade temperature reached 117°.

## Land-Planning under the New Deal.

By L. Dudley Stamp, B.A., D.Sc.

*Director of the Land Utilisation Survey of Britain.*

*Dr. Dudley Stamp, in the course of a long and thorough examination of land conditions in the United States, found the situation difficult and dangerous, though not hopeless. The Americans are tackling the problem with their customary energy; and we may well derive profit from their experience. Dr. Stamp makes some very wise and timely suggestions, worthy of careful consideration.*

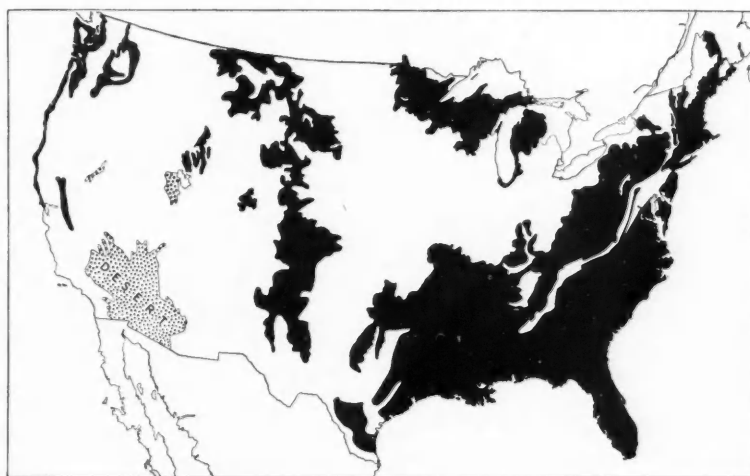
THIS year, for the third year in succession, public sympathy all over the world has been aroused by reports of the disastrous dust storms which have swept over large areas of the United States, paralysing business and cutting communications, driving before them thousands of farmers whose lands have been ruined, and whose very homes lie buried beneath the accumulating mantle. It has been necessary to provide citizens with "dust-masks" of patterns recalling gas masks, and already disease is stalking in the wake of the dust pestilence. Spectacular as they are, these dust storms are but one indication of a far more widespread evil. Since the white man spread westwards across the North American

continent, millions of acres of forest have been felled, millions of acres of grass-land have been brought under the plough. Yet it is only within the last few years that it has been realised how utterly wrong have been many of the methods employed in this supposed "conquest of Nature." Robbed of their natural covering of grass, vast areas laid bare

by the plough have no protection against the erosive action of wind; every storm sees the soil being lifted in clouds and swept away to distant areas where it is piled up in useless heaps against any obstacle in its path. In damper areas the removal of the forest cover has exposed hillsides to the destructive action of rain; little runnels soon develop into gullies and gullies into deep channels. The deep channels drain the water

from neighbouring lands and so lower the water table with the result that orchards planted by man die before they reach the age of bearing. At the same time the rapid run-off causes disastrous floods at lower levels. In other areas the pioneer has been too bold. With infinite labour he has cleared areas whose poor stony soil will never yield him a harvest sufficiently abundant to repay his toil; elsewhere he has ploughed land where a precarious rainfall means that he can only hope for a harvest one year out of every three or four. Not only has he spent his labour and his money in vain; he is in debt, his taxes are unpaid; with nowhere else to go, he is chained to the land he has mistakenly tried to tend.

Robbed of his all, he must needs live on the charity of the State or of his neighbours. In the United States to-day there are millions of acres of "tax-delinquent" land on which the disillusioned pioneer struggles to live. It has been rightly said that the world is being fed below cost and only on the best and most suitable land can the



*Map of the United States, showing (in black) those areas where there is a predominance of land, the proper use of which is still uncertain.*

farmer hope to pay his way, yet good land is widespread in the States, and there is even a surplus of foodstuffs.

As in many parts of the world, the age of exploration in the United States is over. In that vast area of 3,000,000 square miles the proper use of a third of the land is to-day uncertain. That a third of the land has been wrongly used is certain, and the world depression has hastened the already urgent necessity of studying

the land and replanning its uses. Land utilisation is the problem of the moment; it affects an area eight times that of the whole of the British Isles. The position as far as the whole country is concerned is summarised in the map on page 219.

This map is based on a large and detailed one entitled "Major Land Use Areas in the United States" published by the Department of Agriculture in 1933. It shows at a glance the huge area presenting urgent problems. The blank areas—areas where the proper land use is more or less clear—coincide either with the best lands (the wide agricultural lands of the middle West) or with the poorest lands (the forested belts of the Rockies or the North-West, or the deserts of the South-West). The problems due to wrong utilisation arise especially in lands which are of intermediate character, perhaps formerly good but to-day impoverished, or in lands which are not good enough in face of the competition from better and more recently developed areas. It may be instability of climate, it may be poverty of soil, which is mainly responsible. The map clearly illustrates the enormous area involved.

We may distinguish at least six major reasons for the present mal-utilisation of land in the United States:

(1) In the first place there is the history of settlement. When the Pilgrim Fathers landed in New England they laboriously cleared much land which was not worth the effort. All the time subsistence or semi-subsistence



*Soil erosion in South Dakota: soil blown from the fields smothering a young wood, after the dust storms of May, 1934.*

farming was the rule, the settlers eked out a bare existence from such poor land; to-day second-growth forest can be seen covering much of the land they cleared. On all the poor-soil areas of New England, New York State, and elsewhere in the East—and large areas are involved—are to be seen abandoned farms. Some find a new use as summer houses for city workers, others are just swallowed up in forest land. With the opening up of the West, the great tide of population movement swept westwards. Pioneer settlers with a hunger for

land drove their ploughs into the virgin prairie. They had no knowledge of soil or climate. They pushed the "pioneer fringe" too far into regions of uncertain rainfall and much land has been brought under the plough which ought never to have been touched. Then the tide rolled ever onwards—to California and the Pacific Ocean. To-day it is not expansion but consolidation which is needed.

(2) An incredible area of land in the United States has been ruined by soil erosion. It is impossible in this country to realise the ravages of this menace—it is only within the last year or two that they have been appreciated in the country itself. The Soil Erosion Service of the Federal Government is now actively combating the evil, but not before thousands of square miles have been permanently ruined. It is estimated that, every year, for every unit of soil nourishment taken from the soil by crops, *twenty-five times* as much is lost by soil erosion. The evil has arisen by *exposing* the soil to agents of denudation—whether by clearing the forest cover or by ploughing the natural grass cover. Deep ploughing in undulating areas of grassland liable to heavy rainstorms has caused the worst trouble. In the drier areas—as shown in the photographs of South Dakota farms in 1934—not only has the soil been blown away from millions of acres, but it has been deposited in irrigation reservoirs so rapidly as to fill many of them up completely and render them useless for storing water. One such, filled in and now being re-eroded, is shown on page 221. The evil has been accentuated in the great Middle West by the prevailing system of large-scale mechanical farming. The huge rectangular holdings—the common 40-acre fields—are ploughed right across and small drainage channels ignored. But Nature will not be thus ignored and so drainage channels develop, and in the near future the Middle West will take on an aspect not very different from that of eastern England—with grass holding together the banks of streams and the fields occupying the irregular areas between. This is clearly apparent in Illinois.

(3) The United States has been described as the largest federation of free-trade countries in the world. Many of the forty-eight states are as large as the leading countries of Europe and no geographer needs to be reminded of the wide variety of climatic conditions and consequently of productions through the whole. The development of communications—road, rail, and air—and the absence of tariff walls have resulted in a ready interchange of produce over the whole country. The areas best equipped by Nature—by their geographical conditions—are the areas which will survive in the struggle. Thus while cultivation of cereals may have been an economic proposition fifty years ago in New

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England, with the competition of the great grasslands of the prairies that is no longer the case. So much land is either thrown out of cultivation and needs to be adapted to other uses—in the case of poor land to be "retired."

(4) Technical progress—such as the improvement of yield through agricultural experiment and breeding—together with the diminution of world trade—have combined to produce an overproduction of agricultural commodities. There is the immediate necessity of retiring 50,000,000 acres of the poorer lands—the so-called "sub-marginal" land. This is the need dictated by world economic conditions of the moment. But there are 1,000,000,000 people in the world who live on the barest margin of food necessities; there are enormous possibilities of expansion in demand. Land that is agriculturally "sub-marginal" to-day may be required in three years' time. Hence the necessity of studying the land to know its inherent capacity—possibly using a system of rating, say, from one to ten. Whereas land of the lowest four categories—let us say seven to ten—may be "sub-marginal" at the time, land of category seven may be usable later. Here we see the difference between long-range planning on a firm basis and planning for the moment.

(5) The forest wealth of America has been enormously depleted and there remain vast "cut-over" areas. Are these to be left to develop a natural second-growth forest (often of species of inferior utility), are they to be re-afforested, are they to be primarily game preserves, are they to be developed as national parks or recreational

areas for the people? Each tract presents its problems in land utilisation.

(6) Social changes are bringing about new requirements of land. The five-day week has already arrived, the four-day week will come and there will be increasing leisure to be employed. The American is not yet a gardener in the sense that 80 per cent. of



*Aerial view of an irrigation reservoir in New Mexico completely choked by eroded soil, abandoned, and now being excavated by a young stream.*

[By courtesy of the U.S. Federal Soil Erosion Service]

British are, but gardening for pleasure as well as for profit is becoming gradually more important. This will mean a vast change in housing requirements. The open "lot" without dividing or protecting fences does not encourage gardening and may disappear. Small holdings and semi-subsistence farming are not only attracting many but are being encouraged as partial cures for unemployment. Broadly speaking, there is in the United States one car for every 3.5 persons—one for every family. Public transport services—buses and trams especially—are usually poor, since every man has his car. But this profoundly affects planning, for a park fifty miles from the city may be readily used, though the children still need (but do not of necessity get, any more than in Britain) their playground in the immediate vicinity of their homes.

How are these great problems of mal-utilisation of land being tackled? They first attracted really serious attention in 1921, when the Land Utilisation Committee was constituted by the Department of Agriculture. Then President Hoover's great Committee on Social Trends studied far wider aspects, but devoted some of its attention to land utilisation. As a result of a conference held at Chicago a semi-official committee, again mainly from the angle of agricultural production, was set up—under the title of the National Committee on Land Use. The Roosevelt Administration on coming into being in 1933 grasped the wider problem, and the National Planning Board was set up under the chairmanship of Frederic Roosevelt Delano, uncle of the President. Its two members were famous economists,



*A tiny cyclonic dust storm in New Mexico. Such storms are of hourly occurrence, but may herald a dust storm of great extent.*

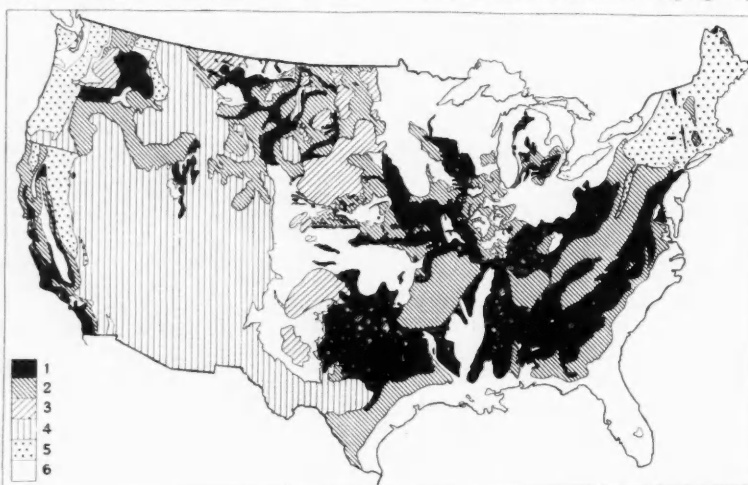


Charles Merriam and Wesley Mitchell, its secretary and administrator Charles Elliott II. This National Board asked every State to set up a State Planning Board and the majority of the States have responded. In the summer of 1934 the National Planning Board was enlarged by the inclusion of the appropriate Secretaries of the Government Departments (including Agriculture and Interior) and its title was changed so that of National Resources Board. This combination of the leaders of official and non-official thought has produced, in December, 1934, a gigantic scheme of development for the whole country.

But what are the individual States doing? It is there that the essential *research* must be carried out on which all planning depends. In most cases the State Planning Board consists of agricultural and forestry experts from the State or other Universities, experts in town and regional planning, leaders of public opinion, and a sprinkling of those whose knowledge or interests in land are from diverse social or economic angles—economists, geographers, social workers. From one State to another the approach to the problem may be extremely different. In nearly all cases, it is encouraging to notice a proper reliance on *maps*. It is obvious that the time for vague descriptions is past: the facts

must be accurately shown on maps. Maps of all kinds are being produced, showing in one form or another attempts at land classification. It may be said that there are two main approaches:

(a) A rough economic zoning: the delimitation especially of "sub-marginal zones" to be retired from agriculture. Sometimes soil maps are available to help in this work, sometimes the delimitation is based on economic conditions.



Map showing the areas of the U.S. which are suffering serious soil erosion. Only the almost level farming country and land still well forested are exempt.

1. Serious erosion over cultivated and overgrazed areas.
2. Harmful erosion over cultivated and overgrazed areas; much serious erosion locally.
3. Much serious wind erosion when cultivated.
4. Predominantly mountainous country with considerable forest, or rolling dry lands and desert; much overgrazing and serious erosion.
5. Predominantly rolling to mountainous; erosion generally not serious.
6. Relatively flat country; erosion generally not serious, though locally bad.

In many areas failure to pay taxes (tax-delinquency) is taken as an index of poor land on which a man cannot make a living. But is it?

(b) A detailed scientific investigation of the potentialities of the land and of its present use. This method has the enormous advantage that it is a sound and secure basis for all time. The topography does not change, neither does the soil. But it is work requiring time, and the work involved is truly appalling in many of the larger States.

But in the long run the scientific background will have to be investigated. It is to be hoped that good solid scientific work such as that of the Soil Survey and Geological Survey will not be curtailed, or be replaced by the more spectacular superficial investigations dependent upon existing economic conditions. It is clear that the solid work must include:

- (a) Completion of detailed topographical mapping;
- (b) Continuance of exact climatological investigations;
- (c) Completion of the Soil Surveys;
- (d) Detailed mapping of land utilisation and ecology;
- (e) Continuous investigation of social and economic trends.

The United States is forging rapidly ahead in land

utilisation surveys. There are those who believe that a sufficiently detailed survey of this kind obviates the need for detailed soil surveys and even of climatological and topographical mapping. The famous botanist, F. E. Clements, points out that the natural vegetation is a real index of the combined influence of topography, soil and climate, that an ecological survey thus tells the whole story provided it is combined with a

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careful land use survey (showing successful and unsuccessful areas under each existing utilisation). It is further realised that any land planning must start from *status quo*—that is from existing land use. The American does not as a rule take kindly to planning. He is an individualist; "rugged individualism" has made the country what it is. Much persuasion is needed before a community is willing to agree that Silas should be turned off his farm because he is in a submarginal region. Only when they see that he cannot pay his taxes, that he is in receipt of relief, that a school has to be kept open for his children, that a doctor has to be within reach, that a road has to be maintained to keep his farm accessible, and altogether that he is costing the country £3,000 or £4,000 a year, will the country agree to a plan whereby he must be moved to better lands\*.

So we find detailed land utilisation surveys in progress in many areas—in Michigan, Wisconsin, Connecticut, Vermont, New Hampshire, New York, California, Montana—to name but a few areas where excellent work has been done. In the course of a recent 20,000 mile tour of the country, spread over nearly a whole year



*Soil erosion in California: a young orchard after a night's rainstorm when 4 to 5 inches of rain fell. This illustrates the danger of clearing wooded slopes and leaving the soil unprotected.*

[Photo. by A. E. Wieslander. By courtesy of the California Forest and Range Experiment Station, U.S. Forest Service.]

and involving visits to forty-seven States, it was enormously encouraging to find a universal interest in the Land Utilisation Survey of Britain. Particularly was America attracted by the published maps as a base for adequate planning, and by the fact that the work has been carried out so largely by young volunteers. Above all America needs the co-operation of the rising generation—"selling the idea" of land planning to them—and desires also the inculcation of the spirit of public service of which such unpaid work is a sure indication.

The American investigation of the problems of land

\* An actual case of this sort could be quoted from Wisconsin.



*Aerial view of a dry area in Kansas, once farmed in rectangular fields, now derelict owing to soil erosion. Note the new drainage system.*

[By courtesy of the U.S. Federal Soil Erosion Service.]

planning is of much interest to Britain; but Britain offers many contrasts to the United States.

(a) In the first place the area is limited—less than 100,000 square miles for England, Wales, and Scotland, or only one-thirtieth of the United States—whilst the average population density is about ten times as great.

(b) So far from suffering under agricultural over-production, Britain produces only about thirty-nine or forty per cent. of her essential food requirements. Just at present the two great nations are developing in opposite directions—America is concerned with retirement of land and the cutting down of agricultural production, Britain with the more extensive utilisation of land and the increase of agricultural production. Such divergence of aim is a consequence of the nationalism so rampant in the world to-day. It may be permanent; on the other hand it may be but the concern of the moment and may be completely changed twenty years hence. Thus once again one sees the necessity of studying the fundamental geographical background—of knowing the *potentialities* of the land.

(c) Much of the land of Britain has been cultivated for a thousand or more years. Contrary to general public opinion there is a *relative* stability of land utilisation. The land that is cultivated to-day is that which was cultivated a hundred, two hundred, three hundred years ago. The heathland and waste lands of to-day have over huge areas been heathland and wastelands for a thousand years. Our woodlands occupy the same lands and represent residual fragments of the primeval forests. Truly on land of intermediate character which it paid to farm a hundred years ago but does not pay to

farm to-day, there have been great changes; on the heavy clay lands ploughland is now grass for exactly the same reason as the farms of New England have changed their character. In other words, Nature has, in old Britain, already dictated the proper use of large tracts of the country.

As in America, all plans must start from the present position—from the existing land utilisation. If it involves uprooting his daily life, the British farmer is no more amenable to "planning" than is his American colleague. Sometimes great and bold changes are clearly needed, but in the majority of cases the most successful regional plans will be those which disturb as few people as possible, where every change proposed from an existing utilisation can be fully justified—e.g., the retirement from agriculture of a strip along a line of beautiful cliffs. In other words, the plan must take full notice of all features of environment. A magnificent example of such a plan is that for Aberdeen, which owes so much to Mr. Henry Alexander, the Lord Provost. In some cases there is the danger of missing the *optimum* use of land. Even the strictly urban planner should be acutely aware of the value of *soil*. It is often possible, and nearly always an advantage, to preserve an enclave of good soil for use as extended vegetable gardens or allotments in the town area. The persistence of fruit and vegetable farming in Middlesex, within fifteen miles of Charing Cross, illustrates the importance of soil even in city planning.

#### Value of the Survey.

Thus a stock-taking of the present uses of land, such as that undertaken by the Land Utilisation Survey, has a permanent value:—

- (a) As a standard of comparison with the past;
- (b) As a record of the present position for correlation with soil and other factors and the determination of any areas under-utilised;
- (c) As a basis for planning for the future.

In conclusion it may be said that both here and in the United States\* efficient long-range planning must proceed by stages, and that danger lies in passing over any one of the essential steps. Seven stages may be postulated: the recognition of the need; the education of public opinion to recognise the need; the all-important detailed investigation or research into the scientific background of the problem; the formulation of a plan and its exhaustive examination; publicity or "selling the idea" to secure the essential co-operation of the public; legislation; and, finally, execution.

\* An excellent summary of what has been done up to date in the United States is given by W. L. G. JOERG in the *Geographical Review* (New York), April 1935.

## An All-Electric Exploring Ship

*The launching and successful trials of the "Artabro," at Valencia, are a good augury for the fortunes of this latest Spanish enterprise, the aim of which is the exploration of the Upper Amazon and its tributaries.*

A REMARKABLE vessel has lately been completed in the shipyards of Valencia, Eastern Spain. It is the *Artabro*, specially designed and built for the scientific expedition of Captain Iglesias to explore the unknown regions and mysterious affluents of the Upper Amazon. Begun in October, 1933, the *Artabro* was launched in February of this year; during the third week in June she carried out her official trials with great success and is due to start her Transatlantic voyage, probably from Seville, on the 12th of next October. The chief of the expedition, Captain Iglesias, is the well-known Spanish aviator who so successfully flew across the ocean to South America in his aeroplane *Jesús del Gran Poder*.

The *Artabro*, the first electric ship of Spain, has been constructed with the greatest care, no item having been omitted which could contribute towards the ultimate success of the expedition. She is a comparatively small vessel; maximum length, 186 ft. 3 in. (57.30 metres); length between perpendiculars, 169 ft. 8 in. (52.20 metres); greatest breadth, 35 ft. 1 in. (10.80 metres); height from keel to principal deck, 16 ft. 3 in. (5 metres); draught, loaded, 6 ft. 7 in. (2 metres); displacement, loaded, 800 tons; speed, with full cargo, 9 knots; electric engines, 500 h.p. The ship's company was primarily limited to 50 men, viz.: chief of the expedition, commander of the ship, 24 officers and scientific personnel, 8 assistants, and 16 sailors; but so insistent have been the petitions to accompany him that Captain Iglesias has increased the number to 60.

An interesting feature of the ship is the double bottom and sides, a precaution against ramming, the intervening space being divided into storage compartments; the bow, too, has been reinforced, in order to resist the shock of collisions with floating objects. The scientific section is a modern wonder. The numerous laboratories and workrooms are equipped with the most up-to-date material, so that on the ship herself every kind of scientific and technical study may be effected with accuracy and precision.

Although the expedition is designed to cover a period of three years, reserve provision has been made for a period of four or five years. No detail has been spared which could make life on the equatorial waterways more comfortable and secure. A double fabric of finest metallic mesh covers the doors, portholes, ventilators, etc., a protection against those virulent insects which are man's bitterest foes in the tropics. The infirmary

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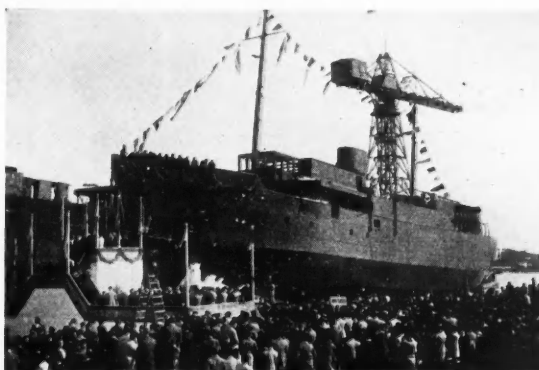
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and its operating room are furnished with all needful accessories. Perhaps the principal factor in insuring comfort is the *artificial climate* which may be obtained within the *Artabro* at any time—the thermometer may be made to drop as low as 8° Cent. (46.4° Fahr.) in the tropics.

Two small eight-metre boats with 50 h.p. engines are provided to navigate tributaries in which the ship cannot pass; while there are four outboards, with a speed of twenty-five knots, and two five-metre lifeboats and two insubmersible rafts, each to accommodate twenty-five persons, as a life-saving outfit. A small hangar at the stern houses two seaplanes with folding wings.

To enumerate the *Artabro's* many modern comforts and conveniences and describe the strength of her structure and the power of her Diesel-electric engines, or the immense variety of her electric plant (ranging from costly laboratory appliances to homely kitchen objects, such as a kneading-trough and washing and ironing



*The launch of the all-electric ship "Artabro" at Valencia.*

machines for the laundry) would require much time and space. It is enough to say that the vessel's equipment from stem to stern is all that a scientific expedition of exploration at the present day could demand or desire.

## Wave-Therapy in Medical Practice.

By Frank W. Britton, D.Sc.

*The eradication of a disease by consulting a scale and turning on a suitable electric current seems a fantastic notion. Yet the development of the use of short-wave frequencies in therapeutics is rapidly approaching this stage, as Dr. Britton shows in this account of the co-operation between radiology and medicine.*

GREAT strides have been made during the past ten years or so in every department of medical science, but probably the greatest have been concerned with the development of exact technique in physical medicine. This branch treats of all those physical agents which have been found of service in the treatment of various diseases—such agents as ultra-violet and infra-red radiation, mechanical vibration, water, etc. Although the majority of these methods have been in existence for some years, it is only during the last few that they have been systematically studied and arranged, as it were, to be of definite use therapeutically.

In consideration of the large number of facts accumulated from many thousands of experiments on the behaviour of the human body when under the influence of electrical stimulation, a Congress of Radiobiology was held during the summer of last year in Venice under the presidency of the Marchese Marconi. At a Congress held last December at the Central Hall, Westminster, the British Institute of Radiology demonstrated an apparatus for the administration of wave-lengths from two-and-a-half to six metres—the first of these representing a frequency of 120,000 kilocycles—ultra-short

waves in fact. I have in front of me as I write, an account of another system of short-wave therapy. My informant is Dr. Daniel Kellner, of Budapest, who very kindly sent me details of some of his clinical observations on the use of electro-magnetic waves of fifteen to forty metres. However, I do not propose to enlarge on his or on any other particular system, but to present in as general a manner as possible, a brief outline of short-wave therapy as it is now being used in clinical practice.

Among the chief effects of short-wave therapy is the deep penetration of the radiation to various depths of tissue. These depths may be reached by interposing several layers of padding between the electrodes, and it is necessary that care should be exercised to prevent the current causing a heating effect on the surface, inducing a painless erythema. Variation in the results of the deep penetration is, generally speaking, due to the resistive capacity of the different organs and structures lying in the field. The views held by experimenters in this subject are interesting. Schliephake, one of the pioneers, believes that the absorption of the waves is much greater in the blood-corpuscles than in the surrounding serum and that they are heated to a greater



extent by wave-lengths of four metres. Another investigator, Cola, discovered that with ultra-short waves of ten metres and less, there is a selective absorption of heat by different organs such as the liver, while the bones themselves attain a higher temperature than the normal under such radiations.

### Diathermic Effect.

There are two different types of short-wave generator in actual use, the valve and the spark-gap oscillators. The first of these is used chiefly for surgical work, the latter typically for the induction of artificial fever. Both generate what is commonly termed a diathermic effect—a deep-seated heating of the internal organs and tissues in distinction to the ordinary surface or superficial heating due to simple galvanisation. It is well known that the effect of galvanic stimulation tends to exercise a vaso-dilator action at the surface of the body and this is typically a hyperæmic condition which follows over-active circulation. Now in the case of diathermy currents the heating effect is not confined to the peripheral vessels but operates in the deeper parts of the body. If, as is the general opinion, different organs may be reached by different wave-lengths, the development of such a technique is of vital importance and thus far the results have proved most encouraging.

Considering the two types of wave generated by the valve and spark-gap systems, it will be seen that the first has a very different wave-form from the second. In fact, a valve fed by a continuous high-tension supply generates a very constant high-frequency energy having a wave-form in which the positive half-phase equals the negative. But in some forms of valve oscillator, the high-tension supply is such that only half of the wave of the a.c. feed mains is rectified, so that the output wave is almost identical with that of the spark-gap oscillator. Hence it is important to use the correct type of generator because the wave-form plays a big part in the specific effects on the various organs.

Where the object is merely to supply heat for cutting operations, as in surgical diathermy, the wave-length need not be particularly short, although one important factor should be borne in mind, that the lower frequencies tend to induce a spreading out of the radiation so that there is not so direct an action upon any one location. For the general production of artificial fever such longer wave-lengths may be used. As we have already mentioned, the great value of the ultra-short waves lies in their penetrativeness and directive application. We must also remember that in penetrating to the deeper layers of the body greater resistances have to be overcome and here is perhaps a good reason why the ultra-short waves are more effective than the long. In this respect, if we

consider that three metres is an average for ultra-short wave-lengths, practical trial has proved that the valve generator has a great advantage over the spark-gap type.

The diseases which have been satisfactorily treated by the ultra-short waves include those of a varicose nature, the generator being of the valve type. On the other hand, perhaps owing to its being in use over a longer period, the spark-gap oscillator has proved its worth in cases of fibrositis, lumbago, and sciatica. One very fortunate property which such a generator appears to possess is its pain-relieving virtue, or hypalgesic action, a very useful condition when treating post-operative cases. The technique of the ultra-short in common with the intermediate and long-wave diathermic therapies is being developed so rapidly that we can anticipate good results, for one of the greatest factors in therapeutics seems to be to stimulate the organism itself to renewed vigour with a consequent resistance towards disease.

Summing up, the system of therapeutic electric waves or diathermy refers alike to the short and long waves, as the able co-Editor of the *British Journal of Physical Medicine* (Mr. B. D. H. Watters) reports. The different distribution of heat depends upon the method of application (whether by condensation or induction) but is independent of the frequency, provided that the same type of generator is used, since, as we have mentioned, the wave-form, even though it is of the same frequency, exercises some different physiological action. Thus, in comparison, the valve type of oscillator is to be preferred to the spark-gap over the same given range of frequencies owing to its uniformity of wave-form.

### A Wave-length for each Disease.

In conclusion I would refer once again to the apparatus which was demonstrated at the recent Congress of the British Institute of Radiology. It is understood that this apparatus has been installed in a well-known London hospital and that a technique is being developed on the theory that different disease organisms absorb definite wave-lengths, a fact which makes it possible to calibrate the instrument with a frequency scale corresponding with named diseases. The assumption is that we have different wave-length characteristics which change according to some pathological condition. Thus, the micro-organisms of disease may be killed by the application of certain oscillations capable of setting up a fatal resonant effect in them—eradicating the entire disease by some very simple operation like the tuning-in of some broadcast station on the domestic radio. However ridiculous this may seem, we shall all welcome its application if it proves to be a further weapon of defence against disease.

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## National Trust News.

THE new Annual Report of the National Trust gives an account of a very great increase in the activities of the Trust in every direction. Owing to the fact that a new policy of preserving land by means of restrictive covenants has recently been adopted, in addition to the older and more expensive method of purchase, it has been possible to secure control over so large an area as 11,000 acres during 1934/35. This is stated to be "the greatest in the history of the Trust"; the area previously protected totalled about 45,000 acres. The importance of this development is at once obvious, but it must be realised that so large an extension of the Trust's work means a great increase in responsibility. It is not surprising, therefore, to find that an appeal is made for more money for maintenance of existing properties, and for the general work of the Society. The National Trust makes the bold claim that it would wish to act as an ideal landlord, and this of course means that it must be ready to lay out funds upon what, in some cases, cannot for many years yield any return. Only too often the National Trust is involved in a capital expense which would not be regarded by a private landowner as a justifiable outlay.

It is greatly to be hoped that the increase in members which has taken place during the past year may continue in the future. The public are only slowly realising that it is possible to join the National Trust. The Committee of the Trust recently made it possible for even more people to be connected with the work that the Society is doing by inaugurating "Associateship," so that those who subscribe 2s. 6d. may become entitled to some of the privileges of membership, whilst full members of the Trust are still those who subscribe 10s. and upwards.

H.R.H. The Prince of Wales, at the National Trust Dinner in February, said: "The National Trust is really everyone's concern, and everyone can do his part to help it in its great work. We all know, most of us here to-night, the heavy demands that are rightly made on our purses by the many charitable institutions and organisations in this country, but I feel that we have a duty towards our countryside as well. Some people are in the happy position to be able to help by gifts of places of natural beauty or historic interest; others, particularly those who have no immediate heirs, can help by leaving property to the Trust. Failing that, all of us can show our appreciation of what the Trust is doing by simply becoming members and making its important work better known."

The Report also acknowledges the help the Trust has received from the other Societies which are working together for the general cause of the preservation of the

countryside. These Societies are, it is well known, linked by the Council for the Preservation of Rural England, and the other most active bodies are the Society for the Protection of Ancient Buildings (which, indeed, manages several properties for the National Trust), and the Commons, Open Spaces, and Footpaths Preservation Society whose Secretary, Sir Lawrence Chubb, is well known as the leading expert on rights of way and the legal questions concerning open spaces.



*The Wool House at Loose, Kent, a recent acquisition of the National Trust.*

A large number of Societies affiliated to the Trust act as local "watchdogs" in various parts of the country. It is only through their valuable assistance, and through the special Local Committees and Local Correspondents of the Trust, that headquarters can keep in touch with the problems of preservation that are constantly occurring all over England and Wales.

Finally, it will be noted with gratification that the Report describes something like a score of new properties acquired during 1934-35. These range from St. Ebba's Chapel and the 18th century lime kilns at Beadnell in Northumberland, to an area of seventy acres near Kynance Cove and the Lizard, the southernmost point of the British Isles.

Amongst the schemes for preservation by restrictive covenants, the two most important are those for the Buttermere Valley in the Lake District, which includes the three lakes Buttermere, Crummock Water, and Loweswater, and was recently completed; and the Malvern Hills preservation scheme, which is intended to safeguard the southern part of the Malverns, if sufficient funds are forthcoming. A grant towards this object has been made by the Pilgrim Trust and augmented by the Midland Counties Trust Fund, but £2,500 must still be found.

## The Griffon Vulture at Home.

By R. Atkinson, J. M. Naish, and E. F. Allen.

*For the first time the Griffon Vulture, one of the largest European birds, has been photographed and observed from close at hand. The result of the authors' observations gives this great bird a much better character than its popular one. Their exploit was a thrilling scientific adventure, and of great value to the study of bird life.*

IN some districts of South Spain a flock of wheeling vultures is as much a part of the skyline as rooks are in England. Popular knowledge about vultures is rather prejudiced and generally extends no farther than an exaggerated idea of the birds' unpleasant and cowardly habits. Yet, when studying them from a hide on a ledge of an Andalusian sierra, we found them both interesting and extraordinarily impressive birds to watch, especially as Griffon Vultures had never before been watched or photographed at close range.

The two vultures inhabiting the mountains of southern Spain are the Egyptian, or Neophron, and the Griffon. Of the two the Griffon is probably the more interesting for it holds the dignified position of being one of the largest, if not the largest, European bird, and, in addition, has the habit, unique among vultures, of nesting in colonies. There were about fifteen nests in the colony which we were fortunate enough to find, though only eight or so were accessible. Of these three were in a row on one rocky ledge; we built our first hide between two of them, four feet away from one nest and about twelve from the other, on which the camera was focused. This nest was little more than a lined "scrape" in the debris of the ledge, but the other, at the back of the hide, was a substantial affair built of broom and bay-tree branches and lined with leaves of the "hand palm." All the nests contained a single large white egg, rather curious in view of the fact that most Accipiters lay two or more eggs, but possibly correlated with the Griffon's sociable habits.

Our photographic attempts from the first hide were hardly successful, for the lighting was suitable only for an hour or two each day and the bird's behaviour was

equally unsatisfactory, although several interesting incidents occurred while an observer was in the hide. On one occasion the parent Griffon returned with a beakful of "hand palm" leaves, but instead of adding them to the nest she merely dropped them over the cliff edge. Another time a falling rock frightened her, and, clumsily sweeping off the nest, she carried the egg with her. This was hardly surprising for, before incubating, this species always draws the egg on to its feet. Happily the egg was not thrown over the cliff but came to rest

less than two feet from the nest. On her return the Griffon made no attempt to retrieve her egg, and merely crouched over the nest wearing, it seemed, an extremely disconsolate and pathetic expression. We returned the egg later, but as the bird's incubation periods grew more and more irregular and less frequent, we finally abandoned photography. The owner of the nest four feet behind the hide had behaved perfectly, so we decided to photograph her from a different hide. The original hide can be seen in the top left-hand corner of one of the accompany-



*This bird was an admirable subject for photography and showed little nervousness. The single large white egg, and the palm-frond nest lining are distinctly seen.*

photographs, taken from the second position. The second bird behaved really very well and we were able to make a series of records of her at the nest. The difference in temperament of these two birds of the same species, nesting within a few feet of each other, was most striking.

It was interesting to note that neither of these two birds ever showed any sign of their carrion-feeding habits. Both the short white down on the head and the soft ruff at the base of the long neck were always in perfect condition. Seen at such close quarters the Griffon Vulture is certainly the most handsome and

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\*Messrs.

exciting bird we have watched, much of its impressiveness being due to the bird's slow and deliberate movements. Nor would we admit cowardice as a trait of this vulture's character, for one infuriated bird, at another nest in which the egg had recently hatched, made determined and threatening dashes at the photographer, who was attempting to film the young one. This was the only time we ever heard a Griffon utter any sound, which was a low wheezing noise.

The Griffon Vulture's powers of flight are, of course, known well enough, and we had plenty of opportunity to study them, standing on the "home" ledge and watching the parent birds circling round. When flushed from the nest the birds would always circle round with wings not fully opened and legs hanging loosely downwards. I have no idea what the significance of this curious flight is, for we observed it only in the vicinity of the nesting ledges. Once we watched a bird leave a peak of the nesting rock



"The nest was a substantial affair of broom and bay-tree branches, lined with the leaves of the hand-palm." On the left appears an abandoned "hide."

and plane majestically down the valley, primaries widely separated and without a movement of its three-yard wings; there was a fifty-knot gale blowing straight towards the bird. This, perhaps, of all our impressions of the great Griffon Vulture, remains the most vivid in our memory.

## Correspondence.

### PRIMEVAL CONVULSIONS.

To the Editor of DISCOVERY.

Sir,—Hartland Quay, North Devon, is a surprising place. One comes upon its romantic wildness on the brink of the Atlantic after passing through an extraordinarily luxuriant valley of two miles in length, but even more striking are the tipped and contorted strata of dark slate and red schist which show in the cliff face and at low tide in the ribbed layers that run seaward.

We knew nothing of this peculiar strata formation till we came upon it accidentally, and after photographing it we were interested to find the following description of it in the 1837 "Transactions of the Geological Society":—

"No words can exaggerate the number and violence of these contortions—sometimes regular, undulating curves, sometimes in curves broken at their points of contrary flexure, and exhibiting a succession of cusps like regular pointed arches—sometimes, though rarely, thrown into salient and re-entering angles."\*

Yours faithfully,

LYDIA S. ELIOTT.

Plymouth.

July, 1935.

\*Messrs. Sedgwick and Murchison.



A fine example of contorted strata at Hartland Quay.

The *Journal of the British Society of Dowsers* (June, 1935) reports that, according to *La Chronique des Sourciers*, the parish priest of Kairouan, in Tunisia, has been able to locate with his pendulum, at the request of the Director of the Carthage Museum, a section of the ancient wall of Carthage at a depth of five metres below ground.

## Colour Blindness.

By Walter Garner, M.Sc.

*In present-day traffic conditions, tests for colour vision are becoming increasingly important. The author describes some of the most interesting tests and reveals how very little is known about the real cause of colour blindness.*

PROBABLY one person out of twenty who read this article is seriously colour blind, and of the remaining nineteen at least five more will possess abnormal colour vision. It is equally probable that most of the colour blind readers are unaware of their defect, and merely ascribe any differences of opinion which may have arisen to the different names given by different people to the same colour.

Dalton, who was the first to investigate the subject scientifically, towards the end of the 18th century, was himself unaware of his own defect until middle age, and the fact was only brought home to him by his walking abroad in sober grey, but wearing a pair of scarlet stockings. It is indeed one of the most curious and striking things about colour blind people, and one which is a constant source of amazement to investigators, that in general colour blind subjects are not only ignorant of their defect, but often resolutely refuse to be convinced that there is anything wrong. Statements of normal people with regard to the difference between a red cherry and its setting of green leaves, are received with pronounced scepticism. It is indeed this peculiarity which makes colour blindness often so dangerous, and possibly many traffic accidents could be explained by an examination of the colour vision of the persons involved.

Many professions require keen colour sense, and the present system of examination of colour vision in schools and universities is by no means sufficiently stringent. It is at least desirable that no student should be allowed to embark upon a career demanding acute colour vision, unless careful examination has proved his eyesight to be normal.

### The Meaning of Redness.

A red-blind person sees red as dark grey, and green as light grey (in terms of normal vision). It is possible to teach such a person all the theory of light and wavelengths, to explain the optical mechanism of the eye, and to point to the nervous system of the brain, but as Dunne says in his fascinating book, *An Experiment with Time*:

"A moment's inspection is enough to show you that for the purpose of conveying to your blind guest a description of redness, there is not a single one of these scientific expressions which is of the slightest use whatever. . . . Concerning the existence of one remarkable characteristic of red he would still obviously know nothing whatever. And that characteristic (possibly the

most puzzling and certainly the most obtrusive of all) is—its redness. . . . Now, redness may not be a thing, but it is certainly a fact. Look around you. It is one of the most staring facts in existence. It challenges you everywhere, demanding, clamouring to be accounted for."

And, it may be added, this "fact" of redness is different for each one of us. The colour blind person sees the colour of cherry and leaf as the same fact, the normal person after staring at a bright red light for some time sees the poppy as black. The eye is continually being tricked, deceived, and deluded by the most simple experiments. Light from a flower garden falls on the root of the optic nerve, and it is not seen. It falls on the central region of the retina, and gives the sensation of the full glory of colour; it falls on the extreme edge of the retina, and the picture is painted in drabs and greys.

### Red-Green Blindness.

The most common type of colour blindness shows itself in an inability to distinguish between red and green. Red, orange, and yellow are confused with each other on the one hand, and green, blue, violet, and purple on the other. Rose, grey, and dull green are easily mistaken for each other, many browns are confused with green, and certain bluish greens with blues.

Dalton's description of his own case may be quoted. "That part of the image which others call red, appears to me as little more than a shade or defect of light; after that the orange, yellow, and green appear one colour, which descends pretty uniformly from an intense to a rare yellow, making what I call different shades of yellow. The difference between the green part and the blue part (of the spectrum) is very striking to my eye; they seem to be strongly contrasted. That between the blue and purple is much less so."

Dalton was unable to see red, but a second form of this type of blindness is an inability to see green. In both cases, however, for reasons which are too lengthy to set out here, the confusions are the same. Such persons see the world mainly in terms of three hues, namely, yellow, blue, and white or grey.

In addition to the acute form of colour blindness described above, there is a milder form which is due to a different cause. There is little doubt that red-green blindness is due to a defect in the nervous retinal apparatus of the eye, but many persons whose optical



apparatus is perfect will still differ when finer colour differences are under discussion. Perhaps 40 per cent. of so-called "normal sighted persons" show some degree of abnormality, and indeed the question may well be asked: "What is normal vision?"

These differences, which are familiar to artists, dyers, and those continually working in colour, often depend upon the presence of a yellow pigment in the eye. This may occur either in the crystalline lens, or in the region surrounding the centre of the retina.

The former type of pigmentation is found mainly in older people, and tends to develop with increasing age. A familiar example of its occurrence is provided by Turner, whose later pictures all contain a preponderance of blue. The yellow pigment cuts out a certain amount of blue and violet light from daylight, and in consequence, to state the position another way, Turner in later life saw the world in daylight, as normal people see it in artificial light. The effect of electric light on such colours as navy blue and violet is well known.

There is a popular shade of green at present in vogue, termed "Marina green." The writer recently saw this shade exhibited in a shoe shop with the designation "turquoise blue," whilst a well-known firm of dyestuff makers advertises that it can be matched exactly with one of their "blue-green" dyestuffs. Differences of opinion such as these are probably largely to be accounted for by differences in yellow pigmentation.

### Three Suggested Theories.

As may well be imagined, the theory of colour vision and colour blindness is a difficult subject. There are as many theories as writers, and at present there is no theory which presents a clear explanation of all the phenomena. The most popular theory is due to Helmholtz, and supposes that the retina contains three sets of nerves (or three photochemical substances, as some prefer to put it), sensitive respectively to red, green, and violet. Colour blindness results when one of these nerves is atrophied or missing.

The Hering theory likewise supposes three sets of nerves, one sensitive to red and green, one to yellow and blue, and one to light and darkness. The red-green nerve reacts in this way: red wavelengths have a building-up action upon a photochemical substance, while green wavelengths have a breaking-down action. The other nerves behave similarly. According to this theory, red-green blindness is due to the red-green nerve being atrophied, leaving the yellow-blue nerve still in action. Despite the simplicity of the theory, many serious objections hinder its acceptance.

Edridge Green's theory is different in character. He supposes that a colour blind eye is sensitive to all

wavelengths just as is a normal eye, but that a colour blind person is one who is unable to distinguish between two wavelengths fairly close together, just as some persons have a bad ear for music and, for example, sing an octave too high or too low. The theory explains some but by no means all of the phenomena of colour blindness. Nevertheless, Edridge Green has produced the best test for colour blindness yet published. It takes the form of a colour lantern, and is based upon the fact that although a partially blind person may be able to distinguish between red and green lights at a distance of say two yards, he would not be able to differentiate between them at a distance of two hundred yards, when the intensity of the light and the angle subtended are much less. The lantern is placed in a dark room, and light is allowed to pass from a small opening through coloured glasses. Comparison has proved that this is certainly the most sensitive and certain of the tests available. Other tests depend upon the inability of a colour blind person to pick out the correct match to a pattern from a number of coloured wools. These tests are open to serious objections, but have their uses. A very popular type of test depends upon intricate designs involving letters or numbers, printed in a suitable colour on paper, on a background which is one of the "confusion" colours for colour blind persons. For example, a letter O may be printed in dots in a pale chocolate colour on a confused background of dots in shades of green. Only a normal sighted person will be able to read the letter.

### A Simple Test.

A recent test devised by the writer depends upon the fact that a brown may be dyed on wool by a mixture of red, yellow, and blue dyestuffs, and this brown may be matched by means of orange and green dyestuffs. A red blind person will be unable to see the red in the tricolour pattern, and it will, therefore, not appear to him to be a match. This test has proved capable of distinguishing between slight differences in colour vision amongst normal persons, without elaborate apparatus.

As a concluding note, it should be mentioned that although red-green blindness is the most common form of true colour blindness, and violet blindness (due to pigmentation) is the most common cause of slightly abnormal vision, there is a third type, which appears fairly frequently. This is termed yellow-blue blindness, the world being seen in terms of red, green, and grey. It occurs when diseased conditions of the eye or the optic nerve are present, and usually develops in persons whose colour vision was previously normal, but so far there is no instance on record of its being congenital.



## Wild Life in Canada.

By W. S. Simpson.

*The threat of extermination that menaced many of the native wild animals of Canada has been met by the creation of spacious National Parks. In the northern wastes man is less in evidence and Nature keeps her own balance.*

FICTION writers, when dealing with the Arctic wastes of Canada, have depicted this vast territory as devoid of animal life, with the exception of the polar bear, walrus, seal, and whale. The report of J. Dewey Soper of the Department of the Interior, following six years spent "up north" in a search for the nesting grounds of the blue goose, shows that flora and fauna abound in the Arctic. Mr. Soper brings back photographs of caribou, white whale, ptarmigan (Arctic willow grouse), Arctic hare, blue goose, musk-ox (herds of which roam the tundras of the Arctic), fox, lynx, and His Sedate Majesty the Arctic horned owl. He reports that ducks, geese, swans and other migratory fowl visit the Arctic during the breeding season in countless thousands.

The nesting ground of the blue goose was at last found on Baffin Island, at 63° N. Lat. Heretofore, nests of this bird had never been seen by a white man, although the Eskimes knew of their nesting places.

Mr. Soper, since his return to civilisation, has been appointed Chief Federal Migratory Bird Officer for the Prairie Provinces, his future duties being to safeguard the vast hordes of migratory feathered life for the generations to come, providing protection in their annual flight to and from the Arctic breeding grounds.

Another aspect of the preservation of wild life in Canada appears in the history of the Elk and the Prong-horned Antelope. These two game animals at one time roamed the Canadian wilds in their millions, but to-day it is estimated the Elk will not exceed fifty thousand for the whole of North America, while the timid Antelope is on the verge of becoming extinct, being saved from this fate only by the conservation work of the Canadian Government. The Elk, or more properly the Wapiti, is the handsomest of all native American deer, and next to the Moose is the largest, resembling the Red Deer of Europe.

This fine animal has suffered at the hands of hunters, who slaughtered thousands merely for the sake of their teeth, which are used extensively as charms and emblems of societies, while their majestic antlered heads have been sought after as trophies of the chase.

The Wapiti is a polygamous animal and in the autumn the bull will climb the crest of a hill, uttering his well-known bugle notes as a challenge. If any other bull accepts the challenge a fight begins, when they crash their antlers together with terrible force till one is vanquished. Sometimes the antlers become so firmly

interlocked that the bulls cannot continue fighting, simply pushing each other and wrestling to get loose. If they are unable to wrench themselves free, they gradually starve, locked together in a lingering death. The Wapiti sheds his antlers in spring and by the end of September he has regained his new set, ready for battle. The largest head so far known had a tip to tip spread of fifty-two inches. The average Wapiti bull at full growth stands five feet high and weighs about seven hundred pounds.

Canada's Prong-horned Antelope is exclusively a native animal, never having been found elsewhere. In 1914 the pitiful condition of this antelope was brought to the attention of the Canadian Government, who immediately established reserves for its protection and propagation, a step that has preserved for posterity these delicate and interesting beasts of the plains.

The eye of the antelope is of marvellous lustre, as keen as it is beautiful. It has the strange faculty of weeping when in distress, and has an uncontrolled curiosity. But though its attention is attracted by unusual movements, it has become extremely wary owing to having been so much hunted.

Early attempts at breeding antelope in captivity proved unsuccessful owing to the effect of the shock of capture; but later a herd of forty-two animals were found feeding near Nemiskam, Alberta. These were fenced in without being disturbed, and they have thriven, evidently unconscious that they had been corralled. In 1920 the number had increased to one hundred, while to-day this herd is estimated at three hundred and fifty.

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NATURE, in one of its recent numbers, reports that serious drought in the U.S.A. has accentuated the problem of overcrowding among the Wapiti population of the Yellowstone National Park. Overgrazing has removed most of the nutritious native grasses, and the "fox-tail" that replaces them is not only of low food value but induces a disease of the gums. Ranching country outside the park boundary is a barrier which the deer will not pass. Two solutions have been proposed: one that about half the total number of deer should be captured, transferred to a central slaughtering station outside the Park, and killed and distributed to destitute Indians; the other that the captured animals should be set free in areas of Montana where they could be hunted by sportsmen. The second plan is that favoured by National Park officers, but they insist that, whatever plan is adopted, it must be carried out promptly, because of the daily increasing seriousness of the emergency.



*Above: Herd of Wapiti in Buffalo National Park, Alberta. A Canadian sunset horizon.*

*Right: Young Wapiti in spotted livery, Riding Mountain National Park, Manitoba.*

*Below: Musk oxen at Cape Sparbo, Devon Island, north of Baffin Island.*



*Left: Caribou, or reindeer, in the pathless snowy waste, near Chesterfield Inlet, Hudson's Bay.*

SOME  
DENIZENS  
OF THE  
CANADIAN  
WILD.

*On the left is a portrait of the Great Horned Owl, whose eerie cry is well known in the woods of Northern Canada. Note the nest, built on the ground, of coarse grass, etc.*

## Immunisation against Typhus.

By Professor Rudolf Weigl\*

of the University of Lwów

*This interesting paper by a well-known worker in the field of immunisation reveals a new method of manufacturing a vaccine. If the facts are established over a period of time sufficient to allow ample comparison of statistics, the system should prove of great benefit to those exposed to the risks of typhus infection.*

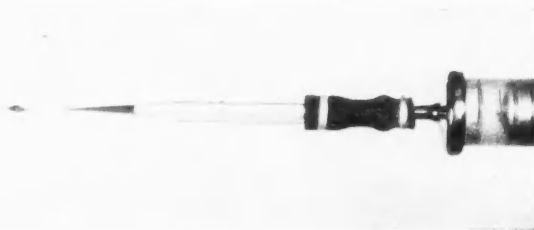
I AM quite certain that if we were not living to-day on a higher level of culture and hygiene than our forefathers, we should now be passing through a period of great epidemics of typhus, not merely in Europe and Asia, but throughout the world. That we are at last able to attack typhus infection at the outset, or at any rate keep it within bounds, is due entirely to the vigilance of our sanitary organisations and to the fact that, thanks to the devoted labours of investigators (especially of Nicolla) we know the real transmitter of the disease—i.e., the human louse—and are able to combat it.

Many research workers have tried to find an effective vaccine against this terrible disease, but for various reasons the methods that have been tried have given unsatisfactory results. Thus, it was found that the blood of typhus patients, when used as a dead vaccine, did not contain enough microbes to afford complete immunity; and other methods, involving the use of living microbes, also proved ineffective. Nor was success attained by employing various microbes supposed to be those of typhus, and obtained by culture in the laboratory. The reason for this is that when the typhus germ, which normally flourishes only in the louse and in man, is transferred to some other medium, its biological character undergoes a change (this has been shown in my own investigations) and it ceases to be a

vate the germ is the louse itself. The procedure, which from a technical point of view has proved unexpectedly easy, is as follows: by means of a capillary glass tube, inserted through the anus into the intestine of the louse, infected matter—such as the blood of a patient—is injected with the help of a magnifying glass, and a competent worker can in this way infect over a thousand lice in a few hours. It was found that a louse thus



*Typhus germs penetrating the endothelium of a louse intestine (x 2000).*



*Infecting a living louse with blood containing typhus germs. The instrument is being introduced into the anus of the animal, an operation which is carried out with the help of a magnifying glass.*

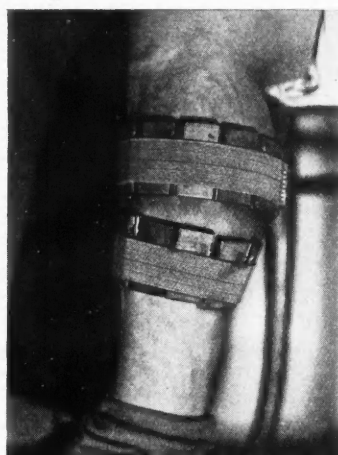
typhus germ at all: in fact, it almost turns into a new species.

I have found that the best medium in which to culti-

infected could take the place of a laboratory culture-medium. The microbes multiply rapidly in the intestine (the louse eventually dying), thus furnishing a culture which can be kept for investigation. I have shown that the microbes thus obtained are genuine typhus germs, and have found that by infecting one set of lice after another with them, in series, a constant supply of vaccine can be made available year after year. The microbe has been named the Ricketts-Prowazek germ, in honour of the investigators Ricketts and Prowazek who both lost their lives in the course of their work on typhus. The best proof that the germ is that of true typhus is that I have caught the infection myself in the course of my work, without having come into contact with any typhus patient: and in all there have been eighteen cases of such infection in my laboratory. In fact, it may safely be said that no one will escape infection during work of this kind if he has not been inoculated—showing that it is a dangerous occupation.

\* Translated by BERNARD LONG from a paper broadcast recently in Esperanto from Polish wireless stations.

The intestine of a louse treated in the manner I have described becomes a sort of bag filled with pure typhus culture, and is an ideal material for the production of a prophylactic vaccine. I do not make the vaccine by using entire lice, but by crushing up the intestines in a suitable fluid, adding a certain proportion of phenol to kill the germs and sterilise the material. Inoculation is effected by giving three doses of increasing strength, and using, in all, the material obtained from the intestines of 150 lice. A louse when infected to the maximum degree will contain from ten to a hundred millions of microbes, so that the total number given to the subject of the inoculation is reckoned in thousands of millions. We are now preparing in our Institute at Lwów enough of the vaccine to immunise a thousand persons a month. For this purpose we have to breed vast quantities of lice, and feed them on human blood twice a day. For the operation of feeding, we put from three hundred to five hundred lice in a sort of shallow cage with a gauze bottom, which is fixed to the arm or leg of a man: the lice then suck his blood through the gauze. One



*Cages containing infected lice feeding on human blood.*

man can in this way feed about 20,000 lice a day. After eight days' feeding the lice are mature, and are then infected with typhus germs in the manner previously described. After this they are fed for another five days, in order to allow the greatest possible increase of the microbes in their intestines, and for this latter feeding we have to employ persons who have either had typhus themselves (and thus become immune) or who have been inoculated against it with my vaccine.

The results of inoculation with the vaccine have surpassed my expectations. Its efficacy is amazing when compared with that of the vaccines used against cholera and typhoid, for instance, and I explain this by the fact that no artificial culture-medium is employed in making it. Twelve thousand persons have already been inoculated with this vaccine. I count it great good fortune, in view of the number of doctors and scientists who have lost their lives in the course of anti-typhus research, that although I have twice had slight attacks of illness through infection in the laboratory I have been able to solve the problem of immunisation against the disease.

## New Discoveries at Lachish.

By E. N. Fallaize.

*The results of another splendid season's work at Tell Duweir, which has now been proved to be the site of the Lachish of the Bible, have lately been on view at the Wellcome Research Institution. Historical finds of the first importance give promise of even more exciting discoveries in the future.*

DURING the season 1934-5, the third in the work of the Wellcome Archaeological Research Expedition to the Near East at Tell Duweir, the site of the Biblical Lachish, some 25 miles south-west of Jerusalem, operations, under the direction of Mr. J. L. Starkey, were in the main devoted to continuing or completing the examination of areas opened up in previous years rather than in breaking new ground. This course, in part, was dictated by the necessity of making provision by constructional and other work for the removal and dumping of the waste products of excavation, as well as for other details of directional organisation.

These, with other considerations, tended to concentrate attention on the south-western part of the Tell around

the gate and bastion, where lay the main approach to the fortress, and the adjacent areas neighbouring on the expedition's camp. In addition to the clearance of the gate and works here, the examination of the Iron Age cemetery was completed in order to leave free space for dumping or other requirements of the camp. Progress was made in the erection of retaining walls and terracing on the west side of the Tell, and preparations carried further for future extensions of the rail for the earth-carrying trucks. These necessary works made a heavy call on time and labour; but on a site of the size and importance of Lachish the preliminary work of providing and organising the "machinery" of excavation is not to be regarded as an unprofitable delay. And,



notwithstanding this drain on the energies of the members of the expedition, both the extent of the season's further exploration and the number and character of the finds bear witness to a more than creditable achievement. In fact, with a single exception, exploratory work was carried further in all of the periods hitherto found to be represented on the site, including the early Copper Age cave-dwellings of the north-western prehistoric suburb of the Tell, the temple contemporary with the XVIII-XIX Dynasties outside the city wall on the north-west, and the Persian palace and shrine on the top of the Tell, which mark the closing period of its occupation somewhere about 450 B.C.

It is interesting to note that the clearing of the remains of the temple, the Persian palace, and the shrine have now made it possible to construct models to scale of these monuments. These models were among the exhibits illustrating the work of the expedition, displayed at the Wellcome Research Institution, Euston Road, London, from June 24th to July 27th. An instructive adjunct to the exhibition was a cinematograph film, showing members of the expedition at work on various parts of the site.

In the preceding season's excavations it may be remembered (see *Discovery*, 1934, pp. 231, 288) the interest of the sanctuary shrine and its associated finds, revealing what appears to be a local school of art strongly reminiscent of the art of Tell el-Amarna, was rivalled only by the discovery of part of an inscription on fragments of an ewer, in an unknown primitive script, showing affinities with the famous Sinaitic script. The chief interest of the discoveries of the present season, too, centres in material that is epigraphic rather than purely archaeological in character. On this occasion the material is of a later date, although, it is true, a further fragment of the early script on a potsherd

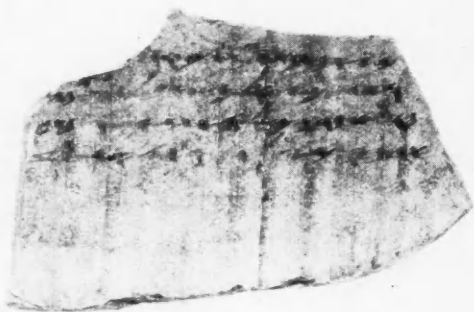
has added three new characters to those already known. The new inscriptions are a series of letters, or parts of letters, written in an early form of Hebrew in the later years of the Jewish kingdom. This find constitutes the most important discovery of epigraphic material yet made in Palestine. Even at the present early stage of decipherment and study it is evident that the letters contain contemporary references to Biblical history of an historical importance, which make Lachish a landmark in the search for corroborative material bearing upon Biblical narrative. They also afford documentary evidence confirming the identification of Tell Duweir with Lachish.

#### Official Views on Jeremiah.

The decipherment of the inscriptions has been entrusted to Professor Harry Torczyner of the University of Jerusalem, who, notwithstanding the faintness of the ink, which it has not yet been found possible to intensify, has been singularly successful in eliciting the purport of the letters. It would appear that they were written by the head of a subordinate command, probably an outpost, to someone in command of the garrison at Lachish, who is addressed as the Lord Yaush. References to the prophet and to the desirability of checking his utterances, which are affecting morale, give an illuminating view at a different angle of events mentioned in *Jeremiah*, xxvi, 20-22. The examination illustrates both the sidelights which may be thrown by epigraphic material on contemporary history, and the acuteness and ingenuity which Professor Torczyner has brought to bear upon the difficult task of decipherment and interpretation.

Turning now to the finds of a more purely archaeological interest, further excavation in the settlement of cave dwellers belonging to the early Copper Age (3000 B.C.-2500 B.C.) of the north-western suburb have added examples of the highly-developed pottery already known from this period. This year's finds include a remarkable example, a tall jar in the characteristic red ware, which approaches a metre in height and has been skilfully reconstructed from fragments. A curious feature of this vessel is that it has been divided in half vertically at some time, apparently intentionally. This is shown by a fissure in the reconstruction, of which the edges have been worn smooth. Among other finds were beautifully-fashioned flint hoes, sickles with serrated edges, and metal work, including a remarkable dagger of pure copper, hammered to a considerable degree of hardness and wonderfully well preserved, which is one of the earliest of the copper daggers that have been found in Palestine.

Mr. Starkey, surveying the characteristics of this and the following period, has pointed out that a process of decadence in culture is to be observed here, which



Potsherd with an early Hebrew inscription, confirming the identification of Tell Duweir with Lachish.

[Photograph by Ralph Richmond Brown,



begins about 2800 B.C. It is especially marked in the pottery, which shows a progressive deterioration in form and quality from the high standard set by the ceramics of the early Copper Age on this site. It is clearly apparent, for example, in the gradual atrophy of the characteristic ledges on each side of certain vessels, which Mr. Starkey suggests may have served as grip handles when ejecting from a jar a solid sediment such as would have been left by beer.

A similar interpretation is placed upon the character of the objects found in clearing the temple and shrine

that recorded as Tomb 521. Here, lying on the ground at the entrance before the ledge on which lay the skeletal remains and effects of the dead, was a large iron three-pronged fork with a short handle. Among the associated finds was a small oblong ivory tablet in which were thirty holes in vertical rows of ten each. It is a reasonable conjecture that here we have the burial of a priest or minor official of a temple, with a form of calendar on which he marked by a minute peg the feast days of each month on which he was to officiate, and the "flesh-hook" with which he extracted meat

An unusual view of the "priest's tomb," photographed from within. On the shelf to the left are seen the skeletal remains of the deceased, and on the floor lies the three-pronged "flesh-hook."

[Photograph by Ralph Richmond Brown.]



outside the city walls at the north-west corner of the Tell. Here also there seems to be a progressive degeneration in the adornment and appointments of the shrine; and it is also to be seen in the contrast between the original form and the two subsequent reconstructions of the temple, which took place between the date of its original erection (c. 1400 B.C.) and its final destruction in 1260 B.C. The beautiful and delicate ivory ornament and inlay of the original are replaced at first by bone and then by clay figures, the portable stone altar becomes a stationary one of brick, and the shrine is of mud lime-plastered. The deterioration in material is accompanied by a parallel decline in style. The bone inlays, which replace those of ivory, are a poor substitute for the delicate art which, as shown in last year's finds, is reminiscent of Tell el-Amarna. A carving in bone of a human head, full-face, exhibited at the Wellcome Institution side by side with what was obviously its ivory original, showed a failure in execution and feeling that was little short of caricature.

Among finds derived from burials of the early Iron Age, the Solomonic period, the most interesting was

from the bin of offerings as described in I Samuel, ii, 13-14.

In the work on the top of the Tell, in the course of which the Persian shrine of the Sun was cleared, a number of interesting small clay objects of quaint and characteristic, if not of determinate, animal form were brought to light and also a number of remarkable miniature, but rough, altars of stone on which are crudely engraved designs of men, animals and trees.

As a whole the results obtained by the close of this third season's excavation at Tell Duweir fully confirm previous impressions of the extent and density of the prehistoric population living in the neighbourhood of the Tell and of the amount of exploratory work to be carried out before knowledge of its cultural history can be regarded as approaching completeness.

In conclusion, the Editor of *Discovery* would wish once more to thank Mr. J. L. Starkey for his generous assistance in bringing his material before its readers, as well as Sir Henry Wellcome and Sir Charles Marston, through whom this valuable investigation has been made possible.

## New York to Moscow—Third Class.

*How a lecture tour in the United States led to an unconventional journey to Japan and China and then on to Russia is described in the following review, which throws interesting light on the situation in the Far East.*

As the *Normandie* now crosses the Atlantic in four days and one can take an airship from Berlin to Buenos Aires, a journey round the world is becoming always less of an adventure; at any rate for the first-class passenger, who can step down from a luxury liner to a Pullman with equal ease in almost any part of the globe. Consequently, travellers who write books nowadays must go out of their way to find novelty; Richard Halliburton swims the Panama Canal or Alain Gerbault dares the oceans in a sailing boat to provide the material for a "best-seller." But between the extremes of conventional travel and exotic adventure, there is still a big field for discovery which Mr. and Mrs. Wedgwood Benn have successfully exploited in *Beckoning Horizon*.\* This book is modestly described as the story of a journey round the world but actually it is a penetrating study of politics, economics, and religious life in three continents.

The journey began with a visit to the United States, but on reaching the Pacific the authors were unable to resist the argument that every step towards the next horizon was in fact a step towards home. Impressions of America, Japan, Manchukuo, China, and Russia were thus obtained in rapid succession, and with the advantage that no hard and fast itinerary had to be followed. Plans were made from day to day and there were many opportunities, denied to tourists, to see life off the beaten track. Journeys were made by omnibus, river steamer, farm cart, and even a sedan chair, and third-class was generally taken in order to mix with the people. Across Asia the travellers limited their luggage to a basket, a suit case and

a kettle, following the Russian practice of making their own tea in the train and at stations. This simplicity of travel did not, however, prevent them from meeting the leading figures in many countries, for as a former Cabinet Minister Mr. Wedgwood Benn was received, among others, by General Chiang Kai-Shek, the Emperor of Manchukuo, the living Buddha of Tibet, and Mr. Litvinoff.

Some of the issues discussed in *Beckoning Horizon* are outside the scope of a review in *Discovery*. The struggle for markets and the problem of man and machine are met with in America, Japan, and Russia; the suppression of liberty is another issue that arises in many forms, while the book throws much light on the conflicting ambitions and forces now working in the Far East. The chapters on life in Russia are frank and disturbing, though the authors make little attempt to take sides and the reader is left to form his own conclusions from the wealth of detail presented.

From the standpoint of *Discovery*, the most interesting chapters are those describing religious and social life in China and Mongolia. The authors spent a great deal of time in an attempt to catch something of the atmosphere of China's complex faith. Religion in America had impressed them as the object of anxious individual searching; in Japan (and later in Russia) as the driving force of national policy; but in China it appeared as the immemorial, conventionalised background to life. Although Confucius, the star of the educated classes, cherished the view (not unknown in modern Europe) that, given only the perfect government, the perfect people will appear, it is impossible to breathe the air of China for long



One of the authors with a group of Tartar gypsies, near Kazan.

\*Cassell, 12s. 6d.

without realising that here is a country where, despite an immemorial culture and two and a half millennia of philosophy, the great bulk of men and women still live and move in a spirit-peopled world. "No Red Indian in his forest or *pueblo* is more wary of the unseen and incalculable powers around him than is the civilised (not necessarily to be identified with the Western-educated) Chinese. On the threshold of temples and rich homesteads stand always the two giant gods, frowning hideously to turn aside the evil spirits that seem always more numerous than the good . . . When driving by car, we were often puzzled and uneasy at the spectacle of a Chinese darting suddenly across our path. Having barely escaped with his life, he would turn and laugh heartily in our direction. We soon learned the reason. By this nimble action he had freed himself of the evil spirit that followed him and as surely transferred its unwelcome attentions to ourselves."

Near Hailar, on the fringe of the Mongolian plain, a visit was paid to a village temple. "A tall, broad-shouldered young lama in the favourite Mongol purple let us in and we sheltered gratefully from the heat of the midday sun under its arching gables coolly tiled in green. Only five lamas lived within its precincts, but the temple had a certain fame and its two tiny



An "obo" or Mongolian shrine, with an artificial bush beribboned and otherwise decorated.

grass-grown courtyards often held lay and priestly visitors from afar. Outside, its appearance was wholly Chinese, but inside the main characteristics were Mongolian. Long benches at right-angles to the altar awaited the officiants and worshippers. Drums and trumpets and many long, thin volumes of the Scriptures and prayers were at hand. The altar held the usual varied objects of worship and appropriate offerings of rice and queerly shaped flour and water cakes. Incense rose up and circled round the tattered and faded silk scarves that hung above. On the high altar itself the central position was occupied by an excellent photograph of the Panchen Lama, likewise draped."

During one expedition into the plains the authors passed by a small comprador trading community engaged in the actual process of barter. A mixed party of Russian and Chinese middlemen had settled down in Mongolian fashion at a convenient distance midway between the town and the great plains, and here came buyer and seller to bargain separately. A group of well-to-do Russian traders, of Semitic appearance, in fur coats (in spite of the June sunshine there were keen winds blowing), stood on one side of a heap of raw wool and hides and the go-between compradors on the



Mongolian prayer-rug, decorated with a primitive picture of a horse.

other. The goods had been brought in earlier in the day by the Mongolian nomad herdsmen, who had received in exchange no money, but some other commodity according to their desires and requirements. Rice, and particularly sugar, were much in favour. Mr. Benn's host never went on an expedition without a large carton of cubes, which he handed out generously to those Mongolians whose tents they visited or whom they stopped to photograph on the way. A broad, delighted smile was always the reward.

On another expedition they visited a solitary *yurta* standing on a small hill at a safe distance above a swiftly-running stream. This one outpost of man threw into relief the loneliness of the plains. The owners extended a very courteous welcome. No children were visible and the family appeared to consist of a father and mother, a grown-up daughter, and one young man, either brother or husband of the girl. They wore the usual indescribable medley of clothing—cloth and animal skins. The older man smoked a civilised-looking pipe and the women wore barbaric ornaments. Conversation was carried on in Chinese, which both the Consul and the Mongolian knew. The family, it appeared, lived by breeding horses and selling them for all purposes, including the sophisticated racing of Shanghai. They had recently removed their *yurta* to this spot and would probably remain for some years there, within an hour's hard gallop of Hailar. "It would hardly be possible to imagine a more lonely spot than this in which to live through the rigours of the desolate Manchurian winter, when for months together the temperature is far below zero. From horizon to horizon nothing moved except the dogs and a sick horse that stirred uneasily near the tent. Even the hundred beasts owned by the family were somewhere out of sight."

Many times, on such journeys, the host stopped the car to collect red and yellow lilies, buttercups, meadow-sweet, and forget-me-nots, with many exclamations of characteristically Japanese delight at this "flower-viewing" which, for him, was almost a ceremony.

### A Lonely Shrine.

At the highest point on a hill, half-way to Hailar, one solitary beribboned bush stood like a beacon on the skyline. On closer inspection it turned out to be an artificial construction of a most interesting kind: a Mongolian shrine, or "obo," connected with the important festival held for the "Prosperity of Man and Beast." A large variety of long twigs, leafy branches, and green vegetation had been gathered together, and their ends set deeply into the ground. This basic structure represented the food of the animals. On the

"tree" thus made were hung large wads of camel's hair, sheep's wool, and handfuls of hair from the tails of horses and cows; the whole tied together with pieces of blue silk scarves, now faded and tattered. This symbolised an offering to the gods from each animal, made in the belief that it would avert sickness among them during the coming year.

Farther out on the plains stood a small temple in Chinese fashion. At the entrance many pieces of the same blue silk had been suspended, along with one festive strip of red cloth. The inside was completely bare, but over the inner gate had been brushed characters that meant "Happiness Temple" and "Whatever you ask of Heaven will be given to you." Quite close to the town of Hailar itself rose another "obo," but this time of a large and imposing kind. Its central pile of branches and brushwood was set on a cairn of stones and encircled by a wooden fence painted in Chinese red. From the twigs themselves flew many flags, composed of white cotton cloths decorated with primitive pictures of horses and cows, all plentifully inscribed in the Mongol tongue. Below the little hill the flocks and herds of the nomads grazed peacefully on green plains that rolled right up to an ominous red brick barracks. To the English travellers this was a strangely significant picture of the old East and the new East, where the shepherd faith of Mongolia met the military ambition of Japan.

## Wireless for Afghanistan.

The Afghanistan Government has placed a contract with the Marconi Company for the supply and erection of five wireless stations in the most important centres in Afghanistan. The installation of an up-to-date wireless system of communication will be a valuable contribution to the development of Afghanistan's commercial and social relations with other countries and an equally important factor in the country's internal communication service. The most powerful of the five new stations will be situated near Kabul and the other four at Maimana, Khanabad, Khost, and Diyazungi.

The Kabul station will communicate with the principal capitals of Western Europe, with Moscow, Tokio, Shanghai, and New York by means of directional aerials, and with Rio de Janeiro, Cape Town, and Melbourne with the aid of omni-directional aerials. This comprehensive scheme of world-wide communication can, if necessary, be enlarged still further to include other places within the scope of the directional aerials, provided the wavelength is suitable. As an example, the aerial directed from Tokio and Shanghai could include Peking.

Automatic transmitting and high-speed recording is provided for one transmitting and one receiving channel, arranged for a maximum speed of 200 words per minute. The receiving and transmitting sites will be separate and will be about ten miles from the City of Kabul, where the control office will be situated.



## The Dwindling Redstart

By Eric Hardy, F.Z.S.

*Now is the time for bird-watchers to look out for the redstart on its autumn migration. Leading nature societies have selected this bird for a special census this year.*

THE sprightly little robin-like Redstart (*Phoenicurus ph. ph.* Linn.), one of the most active and colourful of British nesting birds, is in the list of those birds which find it increasingly difficult to fit their ways in with the urbanisation of the country-side. The worst part of the loss is that this little bird is one of our most useful destroyers of insects.

The redstart was ever a scarce bird west of Essex and north of the Midlands, though odd birds are regularly seen on spring and autumn migration, but because of the seclusion of their nesting haunts (usually in a hole in some wood-side tree, wall, or gate-post, or perhaps an old woodpecker's nest, an old swallow's nest, even a tin can or flower-pot), and the timidity of the bird, many bird-lovers overlook its habitation in their district. However, once seen, this little robin-like bird with a white-spotted forehead, black chin, grey back, and chestnut breast, set off by the often-flicked chestnut-red tail, from which it is named, cannot be mistaken, and though the female bird lacks most of the gaudy colours of her mate, she retains the characteristic colour and movement of the tail. Possibly the increase of the robin in the post-war years, parallel with the increase of bird-boxes, partly accounts for the decrease in redstarts, for the latter are much the weaker birds, and there are cases on record of the aggressive robin killing the redstart.

### Seasonal Movements.

The first spring arrivals of redstarts from their southern winter quarters reach this country in the first week of April, the earliest records being from March 24-31. The majority, however, arrive in the third week of April and birds are arriving up to the third week of May. The return migration starts in July, the earliest return migration recorded being July 10th, 1910, at St. Catherine's Lighthouse, Isle of Wight, while the latest date is November 2nd, recorded in 1911 at the Orkney Skerries, Staffordshire also having a November record. Their distribution in this country is peculiarly confined, like that of many insectivorous birds, mostly to the south-east and home counties. In 1901 the redstart nested in Shetland, and it has nested on Mull, Lewis and the Inner Hebrides, but it is a rare migrant in the Outer Hebrides and in most of Ireland, though a few pairs have nested in Tyrone and

Wicklow. I have never seen it within the bounds of cities where a park or bird sanctuary might attract it, and haunts I have known for years in the Midlands have become much depleted in the post-war years. Perhaps the increased application of bird nest-boxes to woods (rather than their present noisy and only too obvious positions in gardens) and the stopping up of their holes until the return of spring migrants, so that resident sparrows, robins, and starlings will not occupy the boxes, may do something to increase its numbers. We have seen the redstart in a garden by the city on its spring migration, but I have never found a garden-nesting pair.

### Bringing Up the Family.

Like most birds nesting in holes, the redstart makes a simple nest, chiefly a bed of moss, roots, and hay lined with feathers and hair, which contains six pale-blue eggs, like pale, glossy hedge-sparrow eggs, sometimes five or seven, rarely eight or nine. Practically all the incubating of the eggs is done by the female. In a fortnight the eggs hatch, and the young redstarts, when they leave the nest, look like young robins, being brown with buff spots, excepting for the characteristic tail. The cock bird may assist his mate on the eggs during May, but more often he is singing or fly-catching from a post near by. His song is like that of his relative, the stonechat, low, soft, and sweet, but quiet, not loud and outstanding like that of his other close relative, the robin. A plaintive "weet" is his usual call, and if alarmed, a sharp "wee-tit-tit." I have watched a pair of nesting redstarts from a hide in Leicestershire along with one of our ablest field-naturalists, and not once heard the song uttered when the young birds had hatched, so busy was the old bird in catching insects for the brood. Their food chiefly comprises various small caterpillars, small gnats and midges, grasshoppers, beetles, spiders, and an occasional passing butterfly. If the butterfly passed the post of the cock bird, he could swoop down at it and sever the body from the wings as neatly as any cock blackbird, and whilst the four wings fluttered and gyrated to the ground, he hurried back with a whirr of accelerated wings to the cheeping youngsters already craning their heads from the nest-hole in a rotten gate-post. If, however, he flew after a butterfly he made many futile efforts before he caught it, and never made such a neat job of severing the wings, sometimes not doing this until he returned to the nest. A few juicy mealworms thrown from the hide were readily accepted by the redstarts, but this tip, I regret to say, was derived from bird-cagers, who have also been partly responsible for the reduction in the numbers of these birds.

## Book Reviews.

*The Structure and Reproduction of the Algæ.* Vol. I. By F. E. FRITSCH. (Cambridge University Press. 30s.)

Our knowledge of the structure, reproduction, and classification of the algæ has been profoundly modified by results of investigations published within the past fifteen years. The papers presenting these results have been so numerous, and have appeared in so many widely scattered journals, that no one can be expected to be familiar with them unless he is especially interested in this field of research. Botanists, therefore, owe a large debt to Professor Fritsch for giving us the first of two volumes which will include all of these data in one connected account. Naturally, any treatise dealing with the structure and reproduction of all algæ must be a compilation rather than a presentation of original research. On the other hand, it is very unfair to the author to speak of the volume that has just appeared as a mere compilation. As far as the algæ considered are concerned, they are presented in a well written account in which there is a critical evaluation of the pertinent literature. In his preface Professor Fritsch modestly refers to his book as an "introduction." If it is an introduction it is one that should lead to an intimate acquaintance, since there is scarcely a paper, old or new, that is not covered.

The first volume opens with a discussion of the distinction between Algæ and Flagellata, and gives the reasons for including pigmented flagellates with the Algæ rather than with the Flagellata. Following a general account of the structure of the plant body among algæ, and a detailed discussion of the cytology of the algal cell, the author devotes the remainder of the book to a consideration of eight of the eleven classes into which he divides the algæ. These are the Chlorophyceæ, Xanthophyceæ (Heterokontæ), Chrysophyceæ, Bacillariophyceæ (Diatoms), Cryptophyceæ, Dinophyceæ (Peridiniae), Chloromonadineæ, and Euglenineæ. The remaining classes (Phaeophyceæ, Rhodophyceæ, and Myxophyceæ) are to be taken up in the second volume.

The sections dealing with the various classes of algæ are organised according to the exigencies of the case, rather than to a formal plan. Thus, there is a very brief consideration of the Chlorophyceæ as a whole and a detailed discussion of them order by order. In the Bacillariophyceæ, on the other hand, there is an extensive general discussion and a very brief review of the various orders. Irrespective of the manner in which the subject matter dealing with a class is organised, it is fully covered. Some idea of the immense task that the author has accomplished may be seen from his citation of some 2,400 papers and from the fact that each page of text averages ten bibliographic references.

The incorporation of so many data and the reference to so many rare and little-known algæ make the book difficult reading for the average botanist trying to obtain a general view of the algæ. Despite this difficulty it is one that will prove of inestimable value to the student or the research worker who wishes to find out what is known concerning any particular algæ or group of algæ. Its usefulness for this purpose is enhanced by an adequate index and numerous bibliographic references.

In matters of opinion concerning the algæ no two specialists are in full accord. Thus, the reviewer disagrees with Fritsch in his wide separation of the Chlorococcales from the Siphonales, and in his considering *Chara* and its immediate relatives merely an order of the Chlorophyceæ. However, the reviewer also

believes that a review of another man's book is not the place for presentation of his own personal opinion on controversial points. His function is to express an opinion on the manner in which the author has accomplished his task. There is no doubt concerning this. Professor Fritsch has treated the morphology of the algæ comprehensively and in a scholarly manner. One can safely predict that this book will be in almost daily use in botanical laboratories for years to come.

GILBERT SMITH.

*New Pathways in Science.* By SIR ARTHUR EDDINGTON. (Cambridge University Press. 10s. 6d.)

This book is an important contribution to the reading of those who follow the trends of present-day physics. Its substance was given as lectures in an American university last year. Unlike previous books by Sir Arthur this one is not a systematic survey of some part of physics but rather an account of different things in physics which have been exercising him in the past six or seven years; subjects like determinism, probability, the constitution of stars and nebulae, the significance of the constants of Nature, sub-atomic energy. For the mathematically minded (who need not be higher mathematicians) there is a very clear exposition of the theory of groups. There is variety also in the treatment. Besides the facts and theories of physics he gives their philosophical implications. There is, indeed, a good deal of philosophy and philosophising in the book; there is also a polemical chapter at the end in which critics are answered and gently chided. It is a very clever book. The points are made acutely and often with relish. The exposition is very clear. The author is helped there by his gifts for analogy, apposite quotation and telling phrase freely used. The general reader will find some of the chapters difficult because of the subjects discussed; two-thirds of the book, however, should present no difficulty to him.

For the author one of the important issues in science to-day is the burning problem of determinism. On present knowledge does science find a strict sequence of cause and effect throughout Nature? On this the world of science is divided. Some, like Professor Planck, hold that even down in the little world of the atom particles move in exact fulfilment of dynamical laws. Others, like Sir Arthur Eddington, say that there determinism can be ignored because it cannot be proved to be operative, and because atomic theories, as a fact, do not require it. Why drag it in? Another interesting subject at present to the fore is the Principle of Indeterminacy which has arisen because it has been found that no one can observe the course of Nature in the atomic world without interfering with the course of Nature. The author makes it quite clear how this arises and why this inability is not due to an observer's clumsiness or incompetence but is inherent in Nature itself. Another important scientific subject at the present time is the theory of the expanding universe. For nearly eighty years we have known more or less that the universe as a whole is very slowly "running down"; only in the last few years has it been realised also that the finite space which, it is thought, composes it, is slowly expanding, so that everything in it is gradually getting further and further away from everything else. There is variety of opinion on details of this subject. The author's account of the whole matter as well as of his own special contributions to it are

very interesting. If, for example, it is really true that the universe is both running down—that is, its available energy is slowly petering out—and also expanding, what on earth was it like literally in the year one when it was "wound up" and a compact affair. The answer is that it must have suddenly come into existence fully organised!

Very interesting also is the author's discussion of what are called the constants of Nature: the mass of hydrogen, the mass of the electron, the charge of the electron, the velocity of light, and so on. Here Sir Arthur is in the field by himself. He shows how the seven great constants of the Universe may be connected together so that apparently from most unpromising data calculated values of important constants may be derived. Thus, from data about an electron, the rate at which the universe is expanding can be got. Sir Arthur apologises for including this chapter in the book partly because of its difficulty. Actually it is rightly included. It is a piece of work resulting from a wide knowledge of science, a powerful imagination and much courage. The wonder is, not that the calculations settle everything for ever, but that they can be made at all.

The impression left on the mind by this book is what a very rational and simple and yet, at times, an odd a place is this material Universe in which we live. What fantastic things there are arising from the seemingly solid base. How different at times the "real" view of the Universe may be from that of "common sense."! The great trouble about this book is to find time to appreciate it. If scientific books were allowed when one goes into "retreat" this would be the one to take.

A. S. RUSSELL.

*Modern Mystics.* By SIR FRANCIS YOUNGHUSBAND. (John Murray. 10s. 6d.)

A modern statement of the mystical experience, and the position of mystics in modern life is interesting in view of the recent tendency towards its opposite—scholasticism—through the renewed interest in the works of St. Thomas Aquinas; and Sir Francis Younghusband is excellently equipped to interpret their lives, for almost the whole of his written work has been devoted to a sort of intensive spiritual exploration expressed in a sensitive prose which forms an excellent vehicle for such difficult concepts as are entailed in mysticism. Most of his other work has been the result of an attempt to understand the spirit of India, and as the present volume includes accounts of three Hindu mystics, Keshub Chander Sen, Ramakrishna, and Vivekananda, he has the requisite knowledge which enables him to relate their essentially individual experiences to the background from which they developed. One of the interesting things about mysticism, and a characteristic which is brought out by this presentation of a number of mystics from widely differing backgrounds, is that in spite of the individual nature of the experience, its mode of understanding at any rate, is determined by the terms of thought *ordinarily* known to the mystic.

Sir Francis first gives a general explanation of what the mystic is and then he illustrates his theme from the lives of modern mystics of such apparently different nature as a high-caste Hindu, a French nun, a devout Moslem, an English society lady and a Welsh miner. Finally he gives a most interesting summing up showing what they had in common. If there is a fault to find in the author's arrangement of his material it is that he has not given sufficient space either to his introduction or to his summing up, for it is in these parts that the greatest theo-

etical interest lies, the remaining parts of the book being largely devoted to the actual details of the lives of the mystics interpreted.

William James's *Variety of Religious Experience* inaugurated the modern interest in mysticism. Since then Inge's *Philosophy of Plotinus* and Otto's *Das Heilige* show the different reactions of contemporary philosophy to the mystical experience. In spite, however, of widely divergent views on the subject, the changed outlook of physical science has undoubtedly brought about a *rapprochement* between philosophy and mysticism as a revolt against 19th century materialism. The present volume, therefore, does an admirable service in presenting the lives of several mystics for the close scrutiny of the reflective.

*Electrons (+ and -), Protons, Photons, Neutrons and Cosmic Rays.* By R. A. MILLIKAN. (Cambridge University Press. 15s.)

"Millikan's Electron" was first published in 1917, and a revised edition appeared in 1924. This has been greatly expanded to form this new (third) edition, by the writing of six new chapters entitled, "Waves and Particles," "The Discovery and Origin of Cosmic Rays," "The Spinning Electron," "The Positron," "The Neutron and Transmutation of the Elements," and "The Nature of the Cosmic Rays."

The early portion of the book is practically unaltered from the 1924 edition; so little is changed that superficially one is tempted to wonder why the new chapters were not published as a supplementary volume. The early part of the book could have been abbreviated in places without harm (e.g., the chapter on the non-existence of the sub-electron kills the idea very dead).

For the benefit of those who do not already know this standard work one may say that it is an historical treatment of atomic particle physics. It is written by one of the foremost workers in this field, whose experiment on the measurement of the charge of the electron will stand as one of the great physical experiments of all time. It suffers from the disadvantage of historical presentation that it is difficult to gather what is the "accepted" view.

A great many experiments are described, and the author's own conclusions are put forward and discussed. He has attempted impartially to apportion credit to the discoverers of the various particles, always a difficult task when many investigators are working in the same field at the same time and in different countries.

The book can be recommended to students and all who wish for a readable account of experiments on the new particles.

*New Lives for Old.* By J. ELLIS BARKER. (John Murray. 7s. 6d.)

Mr. Ellis Barker is described by Sir Herbert Barker in the introduction to this book as "this most able and most worthy disciple of the famous founder of homeopathy." He is certainly an enthusiast and an iconoclast. The evidence adduced shows him to be endowed with a natural aptitude for dealing with a great diversity of cases of illness, coupled with an optimistic and encouraging outlook directed towards the considerable number of his cases cited as belonging to the class generally labelled "hopeless" or "incurable."

Thirteen of the twenty chapters deal with the treatment of

specific groups of diseases. Actual cases are described in some detail, and the orthodox medical approach and treatment is contrasted with the author's subsequent management. The remedies used are drawn from the very large range of substances mostly not included in the official pharmacopœia which form the armamentarium of the homœopathic physician. The properties of many such medicaments are described, their uses enumerated, and the result in the particular instance is noted. Diet and general habit of life are stressed. On this aspect of the subject the author is particularly instructive. His principles are clearly stated and of considerable importance.

The chapter on the "New Art of Diagnosis" emphasises the necessity of getting the most exact information as to every detail of the patient's habits.

Mr. Barker's criticism of medical knowledge and practice (and, on page 314, of medical ethics) consists generally of statements which would require proof. The reviewer cannot agree entirely that the "vast majority" of operations are unnecessary and harmful; or that "an enormous number of cases, mostly innocent drain throats, are rushed off to hospital because the Klebs-Loeffler (diphtheria) bacillus has been found. Most of the cases are trivial and need nothing but a gargle." The second assertion appears to ignore the danger to the public in deprecating segregation, even if only for observation purposes.

In the hands of adults the book will do considerable good by stimulating thought and by encouraging a reversion to less complicated dietaries. By directing a stream of new ideas into the sometimes stagnant pools of orthodox medicine, nothing but good can accrue. The book can be well recommended as an adjunct to medical writings but not as a substitute for them.

*The Mongols of Manchuria.* By OWEN LATTIMORE. (Allen & Unwin. 8s. 6d.)

There is a glamour about the name of Mongol which has deprived that interesting people of political significance in the eyes of Europe. To the average newspaper-reader, Mongol is but a generic term, associated with almond eyes and high cheek bones; to the somewhat better informed, it conveys the idea of a pastoral people who put tea into their soup.

Mr. Lattimore is the acknowledged authority on the country, who knows both people and language. In this book he gives a general account of the significance of the Mongols in history, and of their political importance at the present day, which has recently been brought to our notice by the coronation of the Emperor of Manchukuo. The author points out that, with the exception of the Ming dynasty, China has been governed for ten centuries by dynasties of at least partly Mongol origin, until quite recently. It was a blend of Mongol and their Tungus cousins that formed the Liao or Khitan empire in the 10th and 11th centuries; this was followed by the purely Tungusic Chin or Nüchen empire, which penetrated down to the Yangtze, until during the 12th century Chinggis Khan and his Mongols pushed them out, and held power until 1368. From the end of the Ming dynasty, in 1644, until 1911, the country was ruled by the Manchus, themselves semi-Mongol and largely dependent upon Mongol support. The coronation of a new emperor in Manchuria, therefore, is only a reversion to the old condition, the emperor having been the traditional link between Manchu, Mongol, and Chinese.

Throughout the early history of China, her vital frontier was inland, embodied in the Great Wall. Then, at the beginning of the 18th century, she felt the pressure of the maritime powers upon her coast, and so the centre of gravity shifted to the sea,

and the Great Wall became a curiosity. Now one of those maritime powers, Japan, has asserted herself upon the continent. Europe and the United States have ceased to be aggressive, and so the centre has shifted back to its secular position. But Japan's position in Manchukuo is not so much a challenge to China as to Moscow, and the author considers a war between her and the Soviets inevitable. When that comes, the Mongols will be an important factor, and Japan likes to have them as allies. They act also as a buffer between China and the communistic menace from the west.

Between the Chinese and the Mongols the difference is fundamental. The former look upon the latter as barbarians, but they revel in their barbarism; the Mongols despise the Chinese as soft and degenerate, feeling the dignity of their own pastoral life, self-supporting, and independent of money; they look down upon what Mr. Lattimore calls the "morally questionable ease of civilisation." At the same time, the effect of contact with Chinese culture was inevitable. Chinese penetration began, social before it became political, and, with the reduction of pastoral land to arable by the Chinese, demoralised the Mongols and lowered their standard of living. The relations between the vigorous Mongols and the refined Chinese has been analogous to that between the barbarians of the Balkans and the state of Byzantium.

The once powerful people have sunk low. Their territory, nearly as great as the United States, inhabited by a total of some five million Mongols, has been divided. Outer Mongolia is under the control of the Soviets, but it seems that the Russians have done good work here. Inner Mongolia is divided between China and Japan.

Dr. Lattimore explains that the Mongols, Tungus, and Manchus are of kindred stock. The Tungus have a different history, having developed, under a more northerly environment, an economy dependent upon the reindeer and the dog. Unlike the racially tenacious Mongols, the Tungus and Manchus tend to become absorbed. Along the lower reaches of the Lena the Tungus, an attractive people, are rapidly being yakutised, while the Manchus survive, as a national entity, only in a few villages in the Nonni valley. While the Mongol tradition is tribal, the Manchu is dynastic, but as the two have been for centuries in alliance, the coronation of Pu Yi has for the Mongols a very real significance, which has escaped most European observers.

As a contribution to history the book is of great interest. It explains many episodes and tendencies in early Chinese historical development in modern phraseology. All who wish to understand the problems of the Far East should have it on their shelves.

MALCOLM BURR.

*Before the Dawn of History.* By CHARLES R. KNIGHT. (McGraw-Hill. 8s. 6d.)

Mr. Knight has certainly succeeded in putting together a series of the most interesting, often startling, pictures of prehistoric animals that we have ever seen. It does not seem of the first importance—nor indeed possible—to secure in such a work absolute scientific authority for every detail. Mr. Knight has, however, good scientific grounds for his general outlines, and seems to have made a life-study of the reproduction of such forms, partly on artistic lines, mainly on the basis of their skeletal remains and in consultation with the best experts, especially in the American museums. He gives a short and evidently a truthful account of how he has proceeded in this work during the last forty years. There are some forty or fifty full-page



illustrations—only two or three of them relating to man—about as many pages of letterpress and an introductory "Chart of Geological Time," based on the animal forms portrayed. As stirring the imagination and exciting the curiosity about the genesis, mode of life and of extinction of these monstrous forms, this book is to be commended. It does not profess to do more; and if it sends the young student to more detailed sources of information, above all if it increases the public interest in the earlier stages of life on the planet, Mr. Knight's labours will have been well rewarded.

*Crystal Chemistry.* By DR. O. HASSEL. Translated from the German by R. C. EVANS. (Heinemann. 6s.)

Since it was demonstrated by Laue in 1912 that X-rays could be used to determine the exact positions of the individual atoms in a crystal, the necessary data have become available for a more or less complete understanding of the laws of crystal structure in its relation to chemical constitution, and of the individual properties of the constituents of a crystal lattice. And with the great mass of experimental material that has accumulated during the last decade, following the application of this discovery, it has become most desirable to have a text-book giving an easily readable account of this so-called "crystal chemistry."

The book under review aims at meeting this need. Dr. Hassel's book, *Kristallchemie*, certainly does this, and the translation, which has been rendered freely, will be greatly appreciated by the academic student in England; but it is somewhat disappointing to find that the book lacks an explanation of some of the terms used. A short glossary of unfamiliar terms would make it more useful to the general student of physical (and incidentally of crystal) chemistry. For instance, on page 1 we find the word "enantiomorphous," but no information as to what it really signifies is given.

*The Desert Fayum.* By G. CATON-THOMPSON and E. W. GARDNER. Two Vols. (Royal Anthropological Institute. 30s.)

In these two volumes, the one of text and the other containing plates, Miss Caton-Thompson, with the collaboration of Miss Gardner, records the results of three seasons' work between 1924 and 1928 in the Fayum. Miss Gardner was with the expedition for two seasons, acting as geologist, and the result of this happy partnership is a physiographical and archaeological study which not only affords a detailed picture of one of the earliest phases in the development of Egyptian civilisation, but also offers a solution of a vexed problem in the history of the Nile.

The work was pursued under difficulties. It began under the aegis of the British School of Archaeology in Egypt, and when the activities of that organisation were transferred to Palestine the concession to excavate was granted to the Royal Anthropological Institute, but only after the intermission of a year. Hence arose difficulties to which Miss Caton-Thompson refers and of which the importance, apart from the annoyance caused at the time, lies in the fact that early stages of culture were incompletely investigated. The report, therefore, apart from Miss Gardner's work, covers only from the neolithic, but thence it proceeds down to Roman times.

The conclusions which are here drawn from Miss Gardner's observations are entirely subversive of views previously held on the relation of the Fayum depression to the Nile. They go to show that there were two lakes, of which the earlier, of a pleisto-

cene date—its level has now been determined accurately for the first time—either disappeared or shrank to insignificant dimensions for some time, after which a second lake appeared, the lake of the neolithic settlement and the ancestor of that Lake Moeris seen by Herodotus. So far from these lakes having been feeders of the Nile, as has been held, the reverse was the case.

Among the archaeological results by far the most important is the discovery of the two phases of neolithic occupation. Miss Caton-Thompson's investigations have revealed the existence of a neolithic settlement with an extensive and varied flint industry of a remarkably highly skilled technique. It was a settlement of pottery makers living on the lake-shore and subsisting in part, at least, on agriculture. The inhabitants had already attained a certain degree of culture before settling here. Their civilisation did not begin in the Fayum. Notwithstanding the early date (c. 8000 B.C.), they cultivated wheat and barley, possibly the earliest example known, and among the remains of the latter are found specimens sufficiently well preserved to indicate that the species in cultivation was identical with that in use in Egypt to-day.

Of the later phases of culture, predynastic or Old Kingdom, Ptolemaic or Roman, it is impossible to say more here, though the discovery of the ancient irrigation channel aroused much interest at the time and secured the support and assistance of the Egyptian authorities for the expedition. Miss Caton-Thompson has digested a mass of evidence with great skill, a skill which is rivalled only by her care in observation and her meticulous accuracy in recording. She and Miss Gardner have set a high standard for future excavators.

E. N. FALLAIZE.

*Science: A New Outline.* By J. W. N. SULLIVAN. (Nelson, 5s.)

The overwhelming interest in science at the present day is shown by the constant stream of popular books aiming at making the general public acquainted with its main outlines, and especially the latest results. Almost every day some new publication of this kind appears and we noticed recently a very interesting one by Messrs. Andrade and Huxley which erred rather by its multiplicity of experiments and was clearly intended for school and laboratory work. To-day's science-book, which is now under review, differs widely from this, though it is at least its equal in readability. Mr. Sullivan has in mind the average educated person, rather of a literary turn, who wants a well-balanced conspectus but is afraid of mathematical formulæ. His book is admirably written in short clear sentences, and on every doubtful point he is careful to indicate the want of certainty. He never preaches, but he excites an extreme desire to know more and a profound sense of the vastness and importance of what he deals with. The book is a masterpiece of compression and of comprehensive knowledge, for though Mr. Sullivan is himself more familiar with the physical side, and would be glad to give us the formulæ, he is a very competent exponent of the biological side of his subject which occupies the latter part, about a third of the volume. One has, indeed, a curious impression of even greater satisfaction in this portion, where Mr. Sullivan is speaking with the balance and good judgment of a well-trained mind about topics of supreme interest to every thinking person, than in the more detailed account of the different forms of radiation and how they are obtained. It is all extremely well done and the part on life and its problems is a fitting and memorable conclusion.

One feels, after a first reading of this book, a very unusual

sensation—that it would be a good thing to begin it all over again, noting specially those points where Mr. Sullivan has remarked that opinions were divided, or that certain lines of enquiry were being pursued and that it was not yet known where they would lead to. Such a use of the book may be commended to any reader of *Discovery* who wishes to follow the progress of science in its most interesting and important aspects at the present time. A few examples may be given of such problems and the condition of judicial balance in which Mr. Sullivan wisely leaves them.

1. "Modern physics may be regarded roughly as falling into two parts, and at present there is not much connection between them. Phenomena on a minute scale are covered by quantum theory. Phenomena on a grand scale are covered by relativity theory." This on the purely physical side.

2. "We also know that waves of short wavelength are continually reaching the earth from outer space (cosmic rays). It may be that these rays cause the mutations that take place in nature. But that at present is a mere speculation. We believe that mutations are the raw material of evolution and that mutations come about through changes in the genes, but we cannot yet say anything definite about the causes of these changes." This on the borderland between physics and biology.

3. "There are still biologists who are sympathetic to Lamarck's general outlook but the great majority do not accept it."

But whatever the use we may wish to make of it, the book is invaluable and the pleasure in reading it is largely enhanced by the excellent get-up in print and paper and the very moderate price.

F. S. MARVIN.

*The Stone Age Races of Kenya.* By L. S. B. LEAKEY. (Oxford University Press. 35s.)

In this volume and the preceding companion work on the Stone Age industries of Kenya Dr. Leakey has placed before his readers the results of the investigations upon which he has been engaged in a series of archaeological expeditions since 1926. On his interpretation the evidence from Kenya, in conjunction with that from Oldoway in Tanganyika, establishes for East Africa a series of stratified cultures extending from pre-palæolithic to neolithic, corresponding, broadly speaking, in character and date with the European type industries and associated with pluvial and inter-pluvial periods which appear to correlate with the oscillations of the northern Ice Age.

Associated with certain of these stone industries were human remains of varying type, generally, though not universally, admitted by anthropologists to be non-negroid in character. Of these the most important are from the north-eastern corners of the shores of Victoria Nyanza—a lower jaw found at Kanam and fragments of crania found at Kanjera, from which Dr. Leakey has reconstructed two skulls. It is claimed on palæontological, geological, and archaeological evidence, supported by anatomical argument, that we have here in the Kanjera fragments the earliest examples known of "modern man" and in the Kanam mandible the evidence of a type ancestral to modern man and contemporary with man from Piltown and Peking.

Had Dr. Leakey's conclusions been substantiated, it is obvious that he would have carried us a long way towards the solution of the problem of the origin and distribution of early types of man. Unfortunately, as was noted in the April issue of *Discovery*, further investigation by Professor P. G. Boswell has failed to corroborate the evidence upon which Dr. Leakey has relied.

Neither the antiquity of the human remains nor the geological stratification establishing the early sequence of Stone Age industries in Kenya is beyond question. The problem of the appearance of early man in East Africa still remains in suspense.

This unfortunate result, no less disappointing to archaeologists at large than it must be to Dr. Leakey himself, in no way detracts from the debt under which archaeological studies stand to Dr. Leakey. Upon it he has placed a seal with this sumptuous account of his researches, in the production of which the Oxford University Press has not spared its resources.

*A History of the Roman World from 753 to 146 B.C.* By HOWARD H. SCULLARD. (Methuen. 15s.)

Dr. Scullard's survey of Roman history to the destruction of Carthage, in Messrs. Methuen's 'History of the Greek and Roman World' is exactly what has long been needed. Those who have read the successive volumes of the great 'Cambridge Ancient History' must have been impressed with the new material and the new ideas that modern research, and especially archaeological research, has contributed to a study which, a generation ago, seemed to be almost stereotyped in the apparent lack of fresh sources of knowledge. This is particularly true of early Roman history. In the old textbooks it seemed to begin nowhere, in a legendary cloud that lacked substance, and the mere existence, not to say the development, of an independent Rome among the stronger neighbouring peoples bordered on the miraculous. Now that the archaeologist has thrown a flood of light on the early peoples of Italy, the rise of Rome, though not free from obscurity, is at any rate intelligible. And it is one of the chief merits of Dr. Scullard's excellent book that he summarises the complex story of human settlement in Italy and of the several races, especially the Sabines and Etruscans, who unquestionably contributed to the making of the early Roman people. Romulus may well have been a legendary figure, but the site of the city which he was said to have founded was well adapted for trade and defence. The author accepts the stories of the Kings in the same way as we accept the story of Moses and of King Arthur; early Rome was at any rate a tiny kingdom, and had a wise lawgiver like Numa and good fighting men like Tullius and, under the Tarquins, it endured the alien domination of Etruria, even if all the legendary details cannot be accepted.

When we pass on to the early Republic, the atmosphere is clearer, but here too, Dr. Scullard has much to add to the old textbook narrative. He emphasises in particular the prudence of the republican Senate, which for generations was content to enlarge its bounds by pacific alliances with the peoples round about and avoided wars of aggression. The reader must be reminded repeatedly of the development of the British Empire by a similar policy of colonisation and conciliation. Even when Rome embarked on a policy of expansion westward and then eastward, the author is inclined to credit the Senate with a wish to defend its frontiers and its trade rather than with the imperialistic designs too often imputed to it.

His narrative of the long wars with Carthage, Philip, Antiochus, and the rest, is clear and spirited; it is to be noted that he makes a good case for Rome's anxiety to leave the Greeks to settle their own affairs under the Achaean League—a policy that failed, he thinks, through the quarrelsomeness of the Greeks themselves. The book ends with some judicious chapters on Roman life and culture and with appendices on various critical matters, such as chronology and the early treaties with Carthage. There are, too, three useful maps.

EDWARD G. HAWKE.

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